PUBLIC COMMENT PTTGCA AIR PERMIT

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VIA FASCIMILE AND ELECTRONIC MAIL

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Re: Draft Air Pollution Permit-to-Install Initial Installation PTTGCA Petrochemical Complex; Permit #: P0124972

Dear Director Butler:

On behalf of Sierra Club, FreshWater Accountability Project, Earthworks, Center for Biological Diversity, Ohio Allies, Buckeye Environmental Network, Concerned Barnesville Area Residents, Mountain Watershed Association, Center for Coalfield Justice, Ohio Valley Environmental Coalition, FracTracker Alliance, Clean Air Council, and the Breathe Project, we hereby submit the following comments in response to the Ohio Environmental Protection Agency's ("Ohio EPA") opening of public comment on PTTGCA's Draft Air Pollution Permit-to-Install ("draft PTI" or "Draft Permit") for the Petrochemical Complex proposed for Belmont County, Ohio (the "Facility"). Together, these organizations, on behalf of their members, ask Ohio EPA to not approve PTTGCA's PTI for the reasons explained herein, including PTTGCA's submission of a legally-deficient application.

I. Commenting Organizations

Sierra Club

Sierra Club is the nation's largest grassroots environmental organization with more than 626,000 members nationwide, including more than 22,000 members in Ohio and 350 members in Belmont County. Sierra Club's mission is to explore, enjoy, and protect the wild places of the earth and educate and enlist humanity to protect and restore the quality of the natural and human environment. As part of this mission, Sierra Club advocates for a just transition to a clean energy economy. The Facility is at odds with this transition.

FreshWater Accountability Project

FreshWater Accountability Project ("FreshWater") is an Ohio-based, grassroots, nonprofit organization with a mission to preserve fresh water supplies through education and community action, and it is dedicated to promoting the health of current and future generations by protecting the environment. FreshWater has members located throughout the state of Ohio, including members who live, work, worship, own property, and recreate in Belmont County. Through advocacy, legal action, and education, FreshWater strives to protect the very resource that gives us life — our fresh water. FreshWater likewise urges Ohio EPA to look hard at the Project's direct, indirect, and cumulative impacts and, so informed, to uphold environmental standards.

Earthworks

Earthworks is a nonprofit organization dedicated to protecting communities and the environment from the adverse impacts of mineral and energy development while promoting sustainable solutions. Earthworks stands for clean air, water and land, healthy communities, and corporate accountability. The organization works for solutions that protect both the Earth's resources and our communities.

Center for Biological Diversity

The Center for Biological Diversity ("CBD") in an organization with national reach, with members throughout Ohio, including in the area to be impacted by the proposed Facility. CBD knows that the welfare of human beings is deeply linked to nature and the existence in our world of a vast diversity of wild animals and plants. Because diversity has intrinsic value, and because its loss impoverishes society, CBD works to secure a future for all species, great and small, hovering on the brink of extinction. CBD focuses on protecting the lands, waters and climate that species need to survive.

Ohio Allies

Ohio Allies is a grassroots citizen group with members who live, work, and recreate throughout the Ohio River Valley and Southeast Ohio, including in Belmont County. Ohio Allies works to protect our natural and community resources at all levels of government, focusing on local outreach and local decisionmakers.

Buckeye Environmental Network

Through ecological protection and community action, Buckeye Environmental Network ("BEN") (formerly Buckeye Forest Council) seeks fundamental changes that improve our relationships with each other and the land. For over 25 years, BEN has fostered public pressure on government and corporations to protect communities and Ohio's environment. BEN supports clean energy solutions and climate stability. BEN's members live throughout the state of Ohio, including in Belmont County and the Ohio River Valley.

Concerned Barnesville Area Residents

Concerned Barnesville Area Residents ("CBAR") is a community group focused on addressing the environmental risks posed by shale development in the local area. CBAR's members live and work in Belmont County.

Ohio Valley Environmental Coalition

The Ohio Valley Environmental Coalition ("OVEC") is a nationally recognized grassroots organization dedicated to preserving and protecting our natural heritage. OVEC, formed in 1987, is a 501(c)(3) nonprofit organization. OVEC's mission is to organize and maintain a diverse grassroots organization dedicated to the improvement and preservation of the environment and communities through education, grassroots organizing and coalition building, leadership development, strategic litigation, and media outreach. Their work encompasses much of West Virginia and the Ohio Valley.

FracTracker Alliance

FracTracker Alliance is a leading resource on oil and gas issues and a trusted asset to the concerned public. FracTracker studies, maps, and communicates the risk of the oil and gas industry to protect

our planet and support the renewable energy transition. Although FracTracker staff work on issues across the country, the organization has been heavily involved with development along the Ohio River, with staff members on the ground in Ohio and Pennsylvania researching the human and environmental impacts of the petrochemical industry and shale gas extraction.

Breathe Project

The Breathe Project is a clearing house for information on air quality in Pittsburgh, southwestern Pennsylvania, and beyond. The organization uses the best available science and technology to better understand the quality of the air we breathe and provide opportunities for citizens to engage and take action. The Breathe Collaborative is a coalition of 28 regional and national groups of citizens, environmental advocates, public health professionals, and academics working to improve air quality, eliminate climate pollution, and make our region a healthy and prosperous place to live. The Collaborative powers the Breathe Project through science-based work and a community outreach platform.

Mountain Watershed Association

The Mountain Watershed Association ("MWA"), home of the Youghiogheny Riverkeeper, is a non-profit, community-based environmental organization with more than 1,400 members. MWA's major purposes include promoting cooperative community efforts for stewardship and encouraging sound environmental practices throughout Pennsylvania's Laurel Highlands region and surrounding areas.

Center for Coalfield Justice

Center for Coalfield Justice ("CCJ") is a nonprofit organization dedicated to protecting public and environmental health from the adverse impacts of fossil fuel extraction and use. CCJ empowers communities through education, grassroots organizing and coalition building, leadership development, and strategic legal advocacy.

Clean Air Council

Clean Air Council is a non-profit environmental health organization headquartered in Philadelphia. The Council has been working to protect everyone's right to breathe clean air for over 50 years. Clean Air Council has 37,000 activist members.

II. Background

A. PTTGCA's Proposed Petrochemical Complex

The proposed Facility would be an enormous Petrochemical Complex designed to convert natural gas liquids (byproducts that arise during the hydraulic fracturing of shale formations in the Appalachian Basin) into feedstocks for plastics. The Facility is designed to produce 1,500 kilotons per year (KT/year) of ethylene, 700 KT/year of high-density polyethylene ("HDPE"), and 900 KT/year of linear low-density polyethylene/HDPE ("LDPE/HDPE"), and will include rail and truck loading facilities, supporting utilities, and other sizeable infrastructure onsite.

The proposed Facility includes six ethane cracking furnaces, three natural-gas-fired steam boilers, an ethylene production unit, HDPE and LLDPE/HDPE production units, and two flares, among other significant sources of air emissions, including thousands of feet of pipes and valves vulnerable to leaks and the release of fugitive emissions.

The draft permit states the following as the Facility's potential emissions, although, as explained in later sections of this Comment, PTTGCA's application and the draft PTI dramatically underestimate the potential emissions from the facility:

Pollutant	**Annual Emissions (Tons per year [tpy])**
Particulate Matter (PM)	120
Particulate Matter 10 microns (PM_{10})	89
Particulate Matter 2.5 microns ($PM_{2.5}$)	86
Sulfur Dioxide (SO_2)	23
Nitrogen Oxides (NOx)	164
Carbon Monoxide	544
Volatile Organic Compounds (VOCs)	396
Carbon Dioxide Equivalents (CO_2e) (Green House Gases [GHGs])	1,785,043

PTTGCA's application suggests the facility has the potential to cause exceedances of Ambient Air Quality standards ("AAQs") for NOx and $PM_{2.5}$ and that VOC emissions, which include the emission of Harmful Air Pollutants (HAPs), are significantly underestimated.

B. Hazards of the Proposed Site, Former Home to the R.E. Burger Power Plant

The proposed location for the PTTGCA Petrochemical plant is the former site of the R.E. Burger Power Plant. FirstEnergy negotiated the demolition of the Burger Plant and a negligible clean-up effort through Ohio EPA's Voluntary Action Program ("VAP"). Documents submitted to Ohio EPA on behalf of FirstEnergy identify twelve large areas on the property with known or suspected contamination (including the former coal pile area, former ash and settling ponds, underground storage tanks, and former transformer area). This known or suspected contamination includes VOCs, PCBs, polycyclic aromatic hydrocarbons (PAHs), arsenic, mercury, and other heavy metals in soils and groundwater.[1] Despite the serious known or suspected contamination at the site, no significant clean-up took place.[2] Instead, environmental covenants limit the site to industrial use and prohibit drinking of groundwater.[3]

The construction of the PTTGCA Facility is likely to result in disrupting these contaminated soils and may create additional pathways for contaminants to migrate. These serious concerns are in no way evaluated or addressed in PTTGCA's application or by the draft PTI.

III. Risks to Public Health

The proposed Facility would be a major source of air pollution for the surrounding community and the Ohio River Valley. As stated above, these emissions will include large amounts of NOx, $PM_{2.5}$, and VOCs, all of which are known to negatively impact human health.

The residents of Belmont County are particularly vulnerable to air pollution. Belmont County has an older population compared to the rest of Ohio; approximately twenty percent of its residents are over the age of 65, as compared to approximately sixteen percent for the rest of the state. Seventeen percent of county residents are in poor or fair health and nine percent of babies born in the county have a low birthweight.[4] Approximately ten percent of adults and ten percent of children

[1] *See* Nov. 23, 2016 Letter from Environmental Resources Management to Ohio EPA, Re: Review of the Voluntary Action Program (VAP) No Further Action (NFA) Letter for FirstEnergy R.E. Burger Power Plant, 16NFA666; Initial Notice of Deficiency and Review Comments, included and incorporated herein as Appendix 1.
[2] *Id.*
[3] *Id.*
[4] University of Wisconsin Population Health Institute, Belmont County, County Health Rankings and Roadmaps http://www.countyhealthrankings.org/app/ohio/2018/rankings/belmont/county/outcomes/overall/snapshot (last visited Dec. 10, 2018).

in Belmont County have asthma.[5] Belmont County exceeds the state rate of deaths due to heart disease, chronic lower respiratory disease, stroke,[6] and malignant neoplasms.[7]

A. Particulate Matter Emissions

Health risks associated with particulate matter ("PM") depend on the size of the particle involved. Long-term exposure to PM_{10}, even at lower concentrations, is associated with increased cardiovascular mortality.[8] $PM_{2.5}$ is able to pass into the lungs and bloodstream, and exposure to $PM_{2.5}$ is associated with increased emergency room visits, hospitalizations, and missed work and school days due to aggravated asthma or related respiratory complications.[9] Exposure to $PM_{2.5}$ also increases risks for chronic obstructive pulmonary disease ("COPD"), heart disease, stroke, and cardiopulmonary mortality.[10]

The draft PTI and PTTGCA's application states that in every year of operation the Facility will emit 89 tons of PM_{10}, 86 tons of $PM_{2.5}$, and 120 tons of PM. And, as stated above, and explained in detail in later sections of this Comment, these estimates underestimate the Facility's actual potential to emit. The Facility's emissions of $PM_{2.5}$ have the potential to cause violations of National Ambient Air Quality standards, which are set to protect human health.

B. Nitrogen Oxides (NOx)

Exposure to NOx causes coughing, shortness of breath or difficulty breathing, wheezing, increased emergency room visits for asthma, and other respiratory complications like COPD.[11] Children have more serious health impacts from NOx exposure than do adults, due to their relatively smaller

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[5] Ohio Department of Health, Asthma in Belmont County and Ohio, https://odh.ohio.gov/wps/wcm/connect/gov/b52bb8da-0e0d-45d0-93e9-5fe6ff7bc0e1/Belmont.pdf?MOD=AJPERES&CONVERT_TO=url&CACHEID=ROOTWORKSPACE.Z18_M1HGGIK0N0JO00QO9DDDDM3000-b52bb8da-0e0d-45d0-93e9-5fe6ff7bc0e1-mq2RhYM (last visited Dec. 10, 2018).

[6] Belmont County Health Department, Belmont County Community Needs Assessment 2014-2015 at 29, *available at* http://belmontcountyhealth.com/wp-content/uploads/2015/10/Full-CHA-11-5-15.pdf.

[7] Belmont Community Hospital, Community Health Needs Assessment September 2016 at 10, *available at* https://wheelinghospital.org/facilities/bch/CommunityHealthNeedsAssessment_BCH.pdf.

[8] Robin C. Puett et al., *Chronic particulate exposure, mortality, and coronary heart disease in the nurses' health study*, 168 Am. J. Epidemiology 1161 (2008).

[9] *Id.*

[10] Meredith Franklin, et al., *The role of particle composition on the association between PM2.5 and mortality,* 19 Epidemiology 690 (2008).

[11] J. Just et al., Short-term health effects of particulate and photochemical air pollution in asthmatic children, 20 European Respiratory J. 899 (2002).

body mass and higher breathing rates. Higher exposures to NOx have also been associated with an increase in respiratory-related mortality.[12]

C. Volatile Organic Compounds (VOCs)

The VOCs to be emitted by the facility include Harmful Air Pollutants (HAPs) that are known to increase a human's risk in developing cancer and cause other serious health effects, such as damage to the immune system, neurological damage, adverse reproductive and developmental impacts, and respiratory issues.[13] HAPs to be emitted from the Facility include benzene, ethylbenzene, formaldehyde, hexane, toluene, and xylene. Exposure to HAPs may occur through breathing contaminated air; eating contaminated food, such as fruits and vegetables grown in soil where air toxics have been deposited, or meat and dairy from animals fed on contaminated plants; ingesting soil contaminated by air toxics (young children are particularly vulnerable to this exposure route because they ingest soil on their hands and objects they put in their mouths); and skin-contact with contaminated soil, dust, or water (e.g. during recreational use of waterbodies).[14]

D. Ground-Level Ozone (Smog)

VOCs and NOx emissions are also dangerous because they combine to form ground-level ozone, the major component of smog, which causes respiratory problems and reduces lung capacity. The draft PTI and PTTGCA's application suggest the Facility has the potential to result in significantly increased ozone in the surrounding community.

Ozone has been found to cause breathing difficulty, inflamed and damaged airways, COPD, and lungs that are more susceptible to infection.[15] Exposure to ozone has been shown to have these effects in healthy adults, and these health complications can be more serious in people with lung disease and asthma.[16] People with asthma, children, the elderly, and people who are active outdoors (especially those who work outdoors) have greater health risks from ozone exposure.

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[12] Dennis Zmirou et al., *Time-series analysis of air pollution and cause-specific mortality,* 9 Epidemiology 495 (1998).
[13] EPA, Hazardous Air Pollutants, https://www.epa.gov/haps (last visited Dec. 6, 2018).
[14] *Id.*
[15] EPA, Health Effects of Ozone Pollution, https://www.epa.gov/ground-level-ozone-pollution/health-effects-ozone-pollution (last visited Dec. 6, 2018).
[16] *Id.*

Children are the most vulnerable of this group because their lungs are still developing and they are more likely to be outdoors when ozone levels are high.[17]

E. No Health Impact Assessment has been Completed for the Facility.

Despite the known health risks of the pollutants planned to be emitted from the Facility, PTTGCA has not completed, and Ohio EPA has not required, a full health impact assessment to be done to evaluate the impact of this major emissions source on the surrounding community. Such health assessments are regularly used and generally accepted as the best method to evaluate the impact of an air pollutant source on public health because they are able to take into account the cumulative impact of the many pollutants and exposure pathways at issue. The draft PTI and PTTGCA's application do not account for these cumulative health impacts.

IV. Greenhouse Gas Emissions and Contribution to Climate Change

The draft PTI states the Facility has the potential to emit 1,785,043 tons per year of carbon dioxide equivalents. As explained more thoroughly in this Comment, the emissions factor used for this calculation underestimates what are likely to be actual emissions.

In addition, Ohio EPA has not conducted any analysis to assess the indirect and cumulative GHG emissions that would inevitably occur as a result of the Facility's construction. In order to supply the Facility with ethane to "crack" into ethylene, HDPE, and LDPE/HDPE, the facility will rely on an increase in natural gas production in the region, and the associated infrastructure necessary to process and transport natural gas liquids. The Ohio EPA has undertaken no analysis of the cumulative GHG emissions from his increased natural gas and natural gas liquids production and infrastructure, no does it intend to. Likewise, PTTGCA has provided no such analysis. Instead, Ohio EPA will assess sources on an individual basis, never once evaluating the cumulative impact of these GHG emissions.

[17] *Id.*

The Ohio EPA is applying this piecemeal approach to a network of infrastructure known to have high GHG emissions at a time when GHG emissions must be reduced immediately to avoid the most catastrophic impacts of climate change.[18]

V. Comment 1: The Air Dispersion Modeling is Fatally Flawed. NAAQS Violations for NOx and PM are Probable to a Reasonable Degree of Scientific Certainty with Additional Violations Likely if Credible Information is Produced.

There are significant errors in the air dispersion modeling, including in the modeling protocol,[19] which was improperly approved by the Ohio EPA. The principal data inputs used in the modeling, especially surface meteorological data, background emissions, and the Potential to Emit emissions from proposed sources, are flawed and unreliable for an extensive list of reasons described below. Individually, these errors are significant, but collectively, they render the entirety of the modeling and its conclusions to be useless.

While the modeling flaws affect all air contaminants, they are particularly important in consideration of National Ambient Air Quality Standard (NAAQS) violations for NO_2 and $PM_{2.5}$. These two criteria pollutants are closest to causing violations, see Table 6-2 of Modeling Report (p. 18), concluding that the 1-hr NO_2 impact (169.87 $\mu g/m^3$) is over 90% of the corresponding NAAQS (188 $\mu g/m^3$) while the annual PM2.5 impact (9.87 $\mu g/m^3$) is 82% of its corresponding NAAQS (12 $\mu g/m^3$). In addition, as Table 6.3 (p. 19) provides, the PSD Class II Increment and the OAII analyses also clearly show that the $PM_{2.5}$ 24-hour cumulative impact (8.53 $\mu g/m^3$) is almost 95% of the PSD Class II increment of 9 $\mu g/m^3$ and it exceeds the OAII limit of 4.5 $\mu g/m^3$.

Table 6-2. Results of NAAQS Analysis

[18] *See* IPCC, 2018: Summary for Policymakers. In: Global warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty [V. Masson-Delmotte, P. Zhai, H. O. Pörtner, D. Roberts, J. Skea, P.R. Shukla, A. Pirani, W. Moufouma-Okia, C. Péan, R. Pidcock, S. Connors, J. B. R. Matthews, Y. Chen, X. Zhou, M. I. Gomis, E. Lonnoy, T. Maycock, M. Tignor, T. Waterfield (eds.)]. World Meteorological Organization, Geneva, Switzerland, 32 pp., *available at* https://www.ipcc.ch/sr15/ . *See also* USGCRP, 2018: *Impacts, Risks, and Adaptation in the United States: Fourth National Climate Assessment, Volume II*[Reidmiller, D.R., C.W. Avery, D.R. Easterling, K.E. Kunkel, K.L.M. Lewis, T.K. Maycock, and B.C. Stewart (eds.)]. U.S. Global Change Research Program, Washington, DC, USA. doi: 10.7930/NCA4.2018, *available at* https://nca2018.globalchange.gov/?utm_source=newsletter&utm_medium=email&utm_campaign=newsletter_axiosam&stream=top.

[19] PSD Air Quality Modeling Report, Appx C.

Pollutant	Averaging Period	NAAQS (µg/m³)	Modeled Impact (µg/m³)	Background Conc. (µg/m³)	Total Impact (µg/m³)	Exceeds NAAQS?
PM_{10}	24-hr	150	7.37	41.0	**48.37**	**No**
$PM_{2.5}$	24-hr	35	5.99	19.8	**25.79**	**No**
	Annual	12	1.07	8.8	**9.87**	**No**
NO_2	1-hr	188	113.37	56.5	**169.87**	**No**
	Annual	100	2.86	12.8	**15.66**	**No**

Table 6-3. Results of the PSD Class II Increment and OAII Analyses

Pollutant	Averaging Period	PTTGCA Model Impact (µg/m³)	OAII (µg/m³)	Exceeds OAII?	Cumulative Model Impact (µg/m³)	PSD Increment (µg/m³)	Exceeds PSD Increment?
PM_{10}	24-hr	6.77	15	No	7.52	30	No
$PM_{2.5}$	24-hr	6.77	4.5	Yes	8.53	9	No
	Annual	0.90	2.0	No	1.01	4	No
NO_2	1-hr	78.82	188	No	78.83	--	No
	Annual	1.52	12.5	No	1.69	25	No

The following list of errors establish that the Modeling Report does not credibly demonstrate that NAAQS and Class II PSD Increment/OAII will be protected by the proposed facility, and thus, approving the permit based on the current application would violate Ohio Adm. Code §3745-31-05(A).

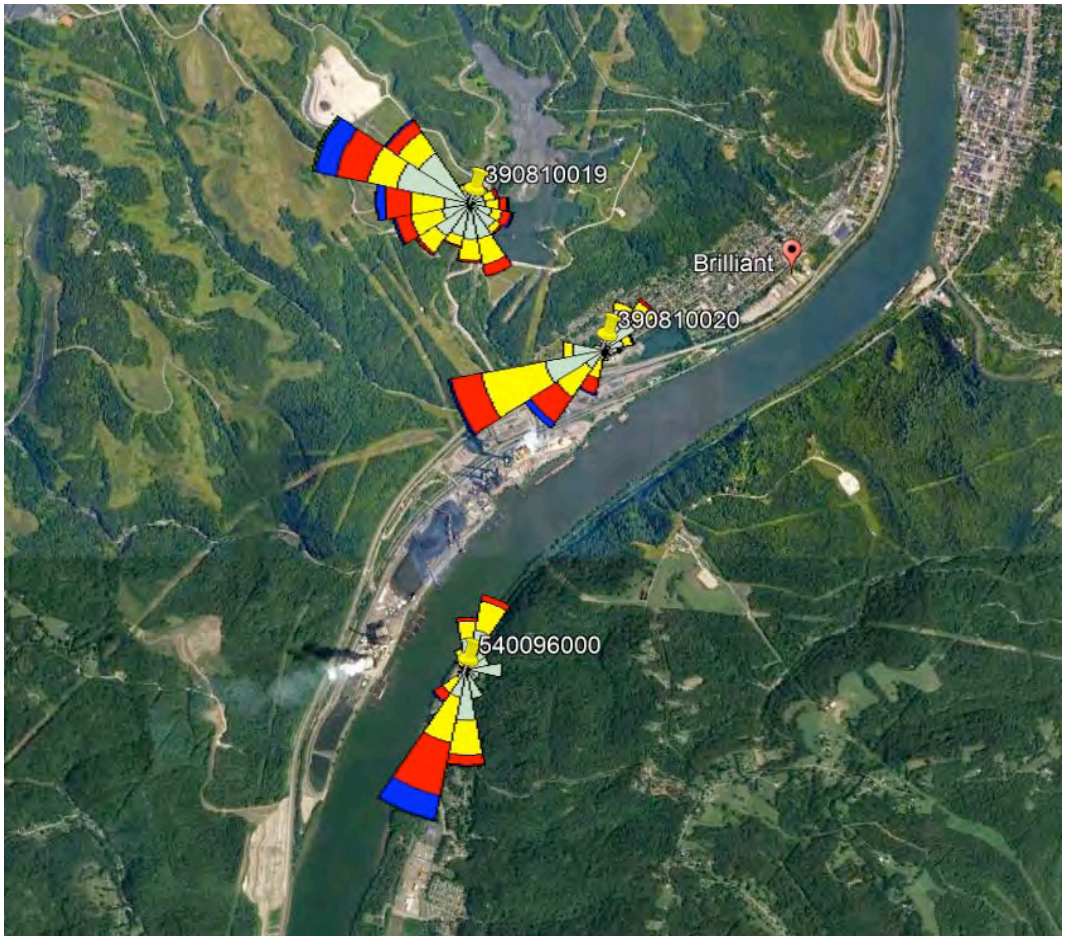
A. Improper Use of Surface Meteorological Data

The proposed plant is to be located in complex terrain in the Ohio River valley, but the modeling analysis does not use on-site meteorological data as required by federal and state modeling regulations and guidance. Instead, the application utilizes meteorological data from over twenty-five (25) miles up-river at the Cardinal power plant and provides no technically valid demonstration that this data is representative of the proposed site. In fact, data indicating that the Cardinal location's meteorological data are not representative of the proposed plant site is simply ignored – by both the applicant and the Ohio EPA. The applicant utilizes this non-representative Cardinal meteorological data in every aspect of its modeling, thereby rendering all the modeling conclusions unreliable.

Ohio EPA should require one year of on-site meteorological data collection, as stated in relevant guidance and regulations, before taking any action on a permit. The applicant has been studying this plant proposal for years and has had every opportunity to obtain on-site meteorological data for its modeling. The fact that it did not is unexplained, which by itself raises serious doubts as to the reliability of its modeling effort. That Ohio EPA went along with this misguided approach is concerning.

As stated in the Modeling Report, the use of non-local meteorological data must be demonstrated as representative before it can be utilized in PSD modeling. Such a demonstration is a significant burden in the complex topography of Dilles Bottom. The Cardinal data are non-representative due to frequent and radical changes in river orientation at Dilles Bottom, which is not the same at Cardinal, while the complex hilly terrain around the Ohio River valley has not been demonstrated to be similar between the two sites. The applicant's Cardinal site wind rose data, see page 11 of its Modeling Protocol, concludes that the prevailing wind direction follows the Ohio River's down-river flow in the center of the river valley but may completely change further away in the hilly terrain, making river orientation and topography at least two parameters that are critical in establishing representativeness.

The Cardinal site shows the River in a general northwest to southeast orientation, in a generally straight direction with only gentle bends in the river, see Figure 4 from page 11 of the Modeling Report:



In marked contrast, at Dilles Bottom, there are two radical bends in the Ohio River immediately adjacent to the proposed plant site, where the river orientation changes quickly from due south, to due west, to due south again, all accompanied by radical shifts in orientation of over 90 degrees within very short distances, see Figure 3 from Page 10:

The radical changes in river orientation at Dilles Bottom has a clear potential to affect the meteorology (and therefore the concentration of air contaminants) in these tight bends which is never addressed in the application. The heaviest concentrations may be in the river itself, especially within the bends. The public will be present at these locations, but the application provides no in-river receptor sites, so any short-term potential peak exposures on the river will escape detection. There is also a special concern for the populated area in Moundsville, West Virginia, to the east of the first radical river bend, that the failure to utilize on-site meteorological data makes the model predictions for Moundsville meaningless.

In addition to the two sites being radically different due to river orientation, the application lacks comparative information on the differing topographical nature of the hilly areas close to the river valley. On its face, given the complexity of the terrain and river orientation (and the interactions between the two), there is simply no reason to believe that meteorological data at the proposed site would be the same or even similar to that at Cardinal, or other locations along the Ohio River. The

fact that Cardinal may only be 25 miles from the proposed site does not matter. Distance is simply not a surrogate for representativeness in complex terrain.

For these reasons, meteorological data collected at the Cardinal site cannot be considered representative of the meteorology at the Dilles Bottom area. The applicant makes no reasoned effort to demonstrate otherwise. Its only claim that it is representative is a statement that the Dilles Bottom site has a northwest to southeast river orientation "similar" to the Cardinal area. This is not only facially untrue, as is clear from the pictures above, but it is also far too general to possess any technical value. The failure of the applicant to obtain the required one year of representative surface meteorological data at the Dilles Bottom site is stark and renders the entire modeling effort fatally flawed.

B. Selective and Flawed Use of Background Concentration Data

NAAQS violations are determined by combining the existing background concentration of pollutants with the modeled level of increased contamination created by a new facility and any cumulative impacts from other existing or proposed sources whose impacts are not captured by the background measurements. The application demonstrates a consistent effort to bias the background levels to low levels by simply rejecting high concentration levels of certain background data simply because they are high – with no reasoned justification that they are invalid or non-representative of current, past, or future conditions. This is impermissible under all modeling protocols in the absence of clear evidence of the rejected data being outliers. Excluding this data appears to have been done simply to avoid the finding of NAAQS violations.

There are multiple examples of this arbitrary manipulation. First, the calculation for ambient NO_2 concentrations simply deletes all data for 2016 without any reasoned justification. The 2016 monitored data demonstrated a higher ambient concentration than other years, see Modeling Protocol, p. 14-15.

Second, $PM_{2.5}$ background levels were arrived at improperly by averaging a monitoring location in Marshall, WV, three kilometers away from the site, with a more distant location in Belmont County six kilometers away, Modeling Protocol, p. 15-16. The closer and presumptively more representative site established a background concentration significantly higher than the level of the distant location. No detailed justification for this use of averaging was provided.

This averaging appears intended to prevent the finding of a $PM_{2.5}$ NAAQS violation. Table 9 on page 16 of the Modeling Protocol shows that the annual background concentration for $PM_{2.5}$ at the more distant Belmont monitor is 7.9 $\mu g/m^3$ while it is 9.6 $\mu g/m^3$ at the Marshall monitor. These values are then averaged in Table 10 to give a final background concentration of 8.8 $\mu g/m^3$. In Table 6-2 on page 18 of the Modeling Report, provided above, the total impact using the 8.8 $\mu g/m^3$ background concentration is 9.87 $\mu g/m^3$ which does not exceed the NAAQS value at 12. If the closer Marshall monitors values alone are used, the total impact is a more critical 10.67 $\mu g/m^3$, which is much closer to the NAAQS. This reduced margin between the NAAQS and the predicted impact could easily be bridged by the many other modeling flaws discussed in these Comments.

The final illustrative example is the applicant's manner of using Table A-1 of its Modeling Protocol, the Regional Source Inventory, that provides emissions data for regional sources of air pollution necessary to calculate background levels for the cumulative modeling analysis. Fifty-one (51) industrial sites in Ohio and West Virginia are included in this Table along with basic emissions and distance information. However, multiple facilities with high background levels appear to have been dropped from consideration in this model, without explanation. The only valid reason for dropping sources is by providing a demonstration that the source's impact is already captured by the background monitoring site. An analysis for these exclusions on specific grounds should be provided so that they can be verified.

These examples are not exhaustive but are illustrative of the general nature of the problems rendering the modelling in this application fatally flawed.

C. Use of Incorrect Emissions Inputs and Flawed Potential to Emit (PTE) Calculations

Valid air dispersion modeling is also dependent on correctly determining the amount of emissions that a proposed facility can be expected to emit. The lengthy list errors in that portion of the application are presented separately in Comment 2 for ease of organization. The information in Comment 2 is incorporated by reference into this Comment, as emissions data constitutes one of the basic components of modeling.

D. Flawed Application of MERP (Modeled Emission Rates for Precursors) to Assess Impacts of Secondary Pollutants Formed in the Atmosphere

The application uses the MERP model to estimate the amount of ozone and fine PM that are formed by photochemical reactions in the atmosphere around the plant due to its emissions of precursor chemicals, i.e., VOC and NOx for ozone and SO2 and NOx for PM2.5. However, the estimates for the MERP model rely on questionable reference conditions that render its conclusions unsound.

Site-specific photochemical modeling is the preferred method for assessing these impacts accurately, but rather than utilize such modeling, the applicant instead utilizes MERP modeling that uses a hypothetical approach to modeling. MERP models develop this hypothetical either from using regional values developed by U.S. EPA or through using a "comparable" plant as a hypothetical source. As calculated in the Modelling Report, using U.S. EPA's regional value for ozone formation determined that ozone formation exceeded the critical air quality threshold by 131%, see Modeling Report p. 23. The applicant then switched to the comparable hypothetical source approach and selected a source in Tuscarawas County, Ohio, approximately seventy miles to the northwest. However, it is readily apparent that this source is not comparable to the proposed plant. The proposed facility is a chemical plant which is a ground level source for the precursor chemicals, such as VOC, and relatively short stacks for NOx; the Tuscarawas County facility is not a chemical plant and releases its precursor emissions from high stacks. The Modeling Report includes no demonstration that the hypothetical source in Tuscarawas County should be deemed comparable from a secondary formation standpoint. Based on this unsupported "comparable" plant, the MERP model concluded that ozone formation was only 58% of the critical air quality threshold.

US EPA's most recent explanation of the draft guidance on MERP use in the PSD permitting program,[20] allows "air quality modeling of hypothetical industrial sources *with similar source characteristics and emission rates of precursors. . .*" at slide 5, emphasis added. The applicant has made no effort to demonstrate any of these similarities. The only possible claim for the Tuscarawas County facility as appropriate is that it may be "located in similar atmospheric environments" due to its proximity, but even this factor fails as there is no demonstration of similarity with the high-stacked facility that is not located within the complex topography of a major river valley. Given

[20]Available as a webinar PowerPoint dated January 19, 2017, available on-line at https://www3.epa.gov/ttn/scram/appendix_w/2016/MERPs_WebinarPresentation_01192017.pdf

this lack of demonstrated similar source characteristics, there is no basis to consider the hypothetical source model as reliable and it must be rejected. The only reliable data provided in the Modeling Report on secondary impacts is the ozone exceedance by 131%.

The Webinar guidance also emphasizes the larger issue involved with the secondary impacts assessment used in the application. Slide 5 also states that "EPA generally expects that applicants would use existing empirical relationships between precursors and second impacts based on modeling systems appropriate for this purpose" as "determined on a case-by-case basis." In other words, the expected compliance tool is a site-specific model, not a hypothetical model. Considering the massive size of this plant and its unique river valley setting for which no relevant meteorological data has yet been presented, the Director should require such a site-specific model before acting on the application.

E. Clarification Needed on Receptors Located in River

This chemical plant presents many short-term scenarios, such as maintenance and malfunction conditions, when high levels of short-term emissions may affect people located close to the plant, including passengers and commercial workers transiting the Ohio River in the vicinity of the proposed plant. It is clear that air in the river is "ambient" air given the ready public access. It is not clear if the modeling included receptors in the river to identify impacts. We ask the Ohio EPA to clarify.

VI. Comment 2: The Application and Draft Permit Use Incorrect Emissions Inputs and Flawed Potential to Emit (PTE) Calculations

Valid air dispersion modelling is dependent on accurately estimating the amount of air contaminants that the proposed plant will release. There are extensive errors in the application and draft permit which cause these emissions to be underestimated. There are three components to this problem: 1) inexplicably inconsistent values in the Air Emissions Inventory, 2) failures to address predictable periodic emissions spikes in calculating PTE, and 3) utilizing unreliable emissions factors based on unsupported assumptions.

A. Emissions Inventory Errors

The Air Emissions Inventory (Appendix C to the application), which provides the emissions side of the applicant's modeling, demonstrates numerous errors that have the effect of understating PTE emissions, making their use in subsequent modeling suspect and potentially masking NAAQS violations. The first example of this pattern (on p. 2 of Appx. C) is the NOx PTE for the six cracking furnaces which show identical operating parameters. But while five furnaces are assigned an hourly NOx emission rate of 5.52 lb/hr, the sixth furnace is assigned an hourly rate of 2.76 lb/hr with no justification provided. Similarly, the three identical Package Boilers have unexplained variances in which Boiler 3 is assigned an emissions rate of "0" for annual NOx, PM, PM_{10}, $PM_{2.5}$, CO, SO_2, VOC, HAPs, and CO_2e, while there are also numerous differences between the emissions rate for Boilers 1 and 2 that are not explained in the application. PTE values for these boilers should be identical. The PTE values assigned to the Thermal Oxidizers demonstrate this same problem with Thermal Oxidizer 2 also being assigned a PTE of "0" for all emissions categories. To the extent that this reflects the intent that only one of these Thermal Oxidizers may be used at any one time, the application provides no engineering details on how this would be accomplished as a practical matter. It is impossible to not have periods of time when both Thermal Oxidizers are operating, even if one is intended to be a "spare."

These differing rates for identical emission sources demonstrate not only an underestimation of emissions, but also a fundamentally flawed understanding of PTE. If there are underlying assumptions supporting the differing PTE values for these identical emission sources, at a minimum those assumptions need to be made express and practically enforceable through firm operational restrictions, monitoring and record keeping in the permit. Otherwise, the draft permit as presently constituted is an open invitation to predictable emissions exceedances and NAAQS violations.

B. Short-Term Peak Emissions Ignored

The best example of the applicant's failure to incorporate predictable periodic spikes in PTE are the emission rates assigned to the HP and LP flares in the Air Emissions Inventory. The rates for both flares are expressly defined as representing their "Normal Operation." This critical term is undefined. The best interpretation of this reference is to a flare's usual operating mode of simply operating on its pilot light which results in a very low PTE. This interpretation is consistent with the low emissions rate assigned to the flares in the inventory. However, the emissions from these

flares will be significantly higher during routine maintenance, start-up and shut-down, as well as in malfunction, and the PTE value in the inventory apparently does not take account of those higher emissions. The PTE values are simply arbitrary without a definition for what is "normal operation" or incorporation of peak emission episodes.

The significance of this omission is apparent on p. 36 of the Inventory containing flaring calculations during MSS: maintenance, start-up and shut-down. This chart demonstrates that the short-term emissions rate from the HP flare can be as high as 77.234 lb/MMBtu for NOx during MSS compared to the lowest value at 0.068 lb/MMBtu. The chart is further based on an assumption (Footnote A) that the maximum rate is based on flaring at just 10% of the design load. No justification is given that this 10% figure represents a maximum in actuality. Despite these high MSS peak emissions, the NOx value assigned to the HP flare on page 2 of the inventory is merely 0.12 lb/hr. The comparable values for the LP flare are a peak of 8.602 lb/MMBtu during MSS but 0.05 lb/hr on page 2 of the Inventory. These numbers make it apparent that the Inventory values do not incorporate the MSS emissions. Further the MSS assumption of the "10% design load" limit is irrationally low because process units at the plant will be depressurized very quickly for maintenance, shut-down, or during malfunction so the plant can get back into operation.

For these reasons, the emission rates assigned to the flares are understating actual PTE emissions from the flares. To address this issue, the draft permit must be amended to 1) state all assumptions on which the flare PTE depend, including actual design capabilities of each flare, 2) state all plausible flaring scenarios and actual emissions during these scenarios, 3) render each of the assumptions involved in the calculation enforceable through incorporating them as permit conditions, and 4) establish a compliance system through effective monitoring and record keeping to establish that the flares operate in practice as assumed in these calculations using quantitative video imaging.

C. Emissions Rates Consistently Unreliable and Unsupported

The emissions rates assigned to sources listed in the Air Emissions inventories are consistently unreliable and unsupported. Virtually none of these rates are based on actual real world and reliable data. The result is that potential emissions from the facility are consistently underestimated for most emissions sources.

D. Misuse of AP-42 Average Emission Factors as Valid Rates for maximum PTE

As established in the Amended Appendix C Emission Calculations spreadsheet accompanying the Air Emissions Inventory, virtually all the emissions factors for the individual sources at the proposed facility are based on U.S. EPA's guidance document, AP-42, a compilation of U.S. EPA's emission factor information. There are many flaws and shortcomings inherent to the use of AP-42 which are freely acknowledged in the guidance by U.S. EPA and users are accordingly cautioned by the Agency to take those flaws into account. These caveats, however, are neither recognized nor respected in this application and, as a result, the emissions predicted are flawed and underestimated.

The primary limitation on the use of AP-42 for PTE calculations is that their factors are designed only to approximate *average* emission rates, not the *maximum* emission rate necessary to appropriately calculate PTE for permitting purposes.[21] While AP-42 may be adequate for small emissions sources posing negligible potential health impacts, the fact that AP-42 is the basis for virtually all the emissions rates for a massive chemical plant in a confined river valley is grossly unsound and a serious misuse of AP-42's intended purpose. As stated by U.S. EPA on page 2 of AP-42:

> Emission factors in AP-42 are neither EPA-recommended emission limits . . . nor standards. . . Use of these factors as source-specific permit limits and/or as emission regulation compliance determination is not recommended by EPA. Because emission factors essentially represent an average of a range of emission rates, approximately half of the subject sources will have emission rates greater than the emission factor and the other half will have emission rates less than the factor. As such, a permit limit using an AP-42 emission factor would result in half of the sources being in non-compliance." (emphasis in original)

From page 3 of AP-42:

> Average emissions differ significantly from source to source and, therefore, emission factors frequently may not provide adequate estimates of the average emissions for a specific source. The extent of between-source variability that exists, even among similar individual sources, can be large depending on process, control system, and pollutant. . . As a result, some emission factors are derived from tests that *may vary by an order of magnitude or more*. Even when the major process

[21] See Ohio Adm. Code 3745-31-01(BBBBB): "Potential to emit" means the *maximum* capacity of an emissions unit or stationary source to emit an air pollutant under its physical and operational design." [emphasis added]

> variables are accounted for, the emission factors developed may be the result of averaging source tests that *differ by factors of five or more.* (emphasis added)

The proposed chemical plant is especially prone to short-term spikes in emissions such as during the maintenance, start-up, shut-down and malfunction conditions discussed above. The problem of short term or peak emissions are identified in AP-42 as a special cause for not relying on AP-42 rates. From page 4 of AP-42:

> Estimates of short-term or peak (e.g., daily or hourly) emissions for specific sources are often needed for regulatory purposes. Using emission factors to estimate short-term emissions will add further uncertainty to the emission estimate. Short-term emissions from a single specific source often vary significantly with time (i.e., within-source variability) because of fluctuations in process operating conditions, control device operating conditions, raw materials, ambient conditions and other such factors. Emission factors generally are developed to represent long-term average emissions so fluctuations in emissions are generally avoided in testing and are not taken into account in test evaluation. Thus, using emission factors to estimate short-term emissions will cause even greater uncertainty. The AP-42 user should be aware of this limitation and should evaluate the possible effects on the particular application.

Rather than rely on these admittedly flawed average emission factors, the applicant should be required to base its calculations on specific emissions testing of the actual emissions sources to be employed at the facility either based on their design or by adjusting the average AP-42 emission factors to reflect maximum conditions, or both. Any real world source of data directly considering the source specific nature of the facility would likely be more reliable than AP-42. None of this was done and, according to AP-42 itself, the emissions factors used to model the facility's emissions are inherently unreliable and give no confidence that the facility is properly modeled.

E. Misuse of AP-42 due to Low Reliability for Natural Gas Combustion Emission Factors, especially for Air Toxics and NOx

Chapter 1.4 of AP-42 specifically addresses "Natural Gas Combustion." The applicant used this chapter of AP-42 for assigning emission rates to the Ethane Cracker Furnaces and Boilers at the facility that are fueled by natural gas, including for setting their emissions rates for NOx, PM, and toxic compounds. However, AP-42 clearly acknowledges in Tables 1.4-2 and 1.4-3, which were explicitly used by the applicant to establish these rates, that these emissions factors are especially unreliable. This was done by assigning an "Emission Factor Rating" to each emission rate which is designed to rate the reliability, or "robustness," of that factor. These Ratings range from A as

best to E as worst ("poor" and not reliable). The Emission Factor Rating in Table 1.4-2 rates the reliability of the N_2O emission factor as "E", PM (total and condensable) as "D", and VOCs as "C." Table 1.4-3 lists the Emission Factor Rating for twenty-six (26) toxic organic compounds resulting from natural gas combustion, with one receiving a "C," two a "D" and the remaining twenty-three (23) the lowest grade of reliability "E." In other words, for most toxics, using AP-42 is little better than merely guessing.

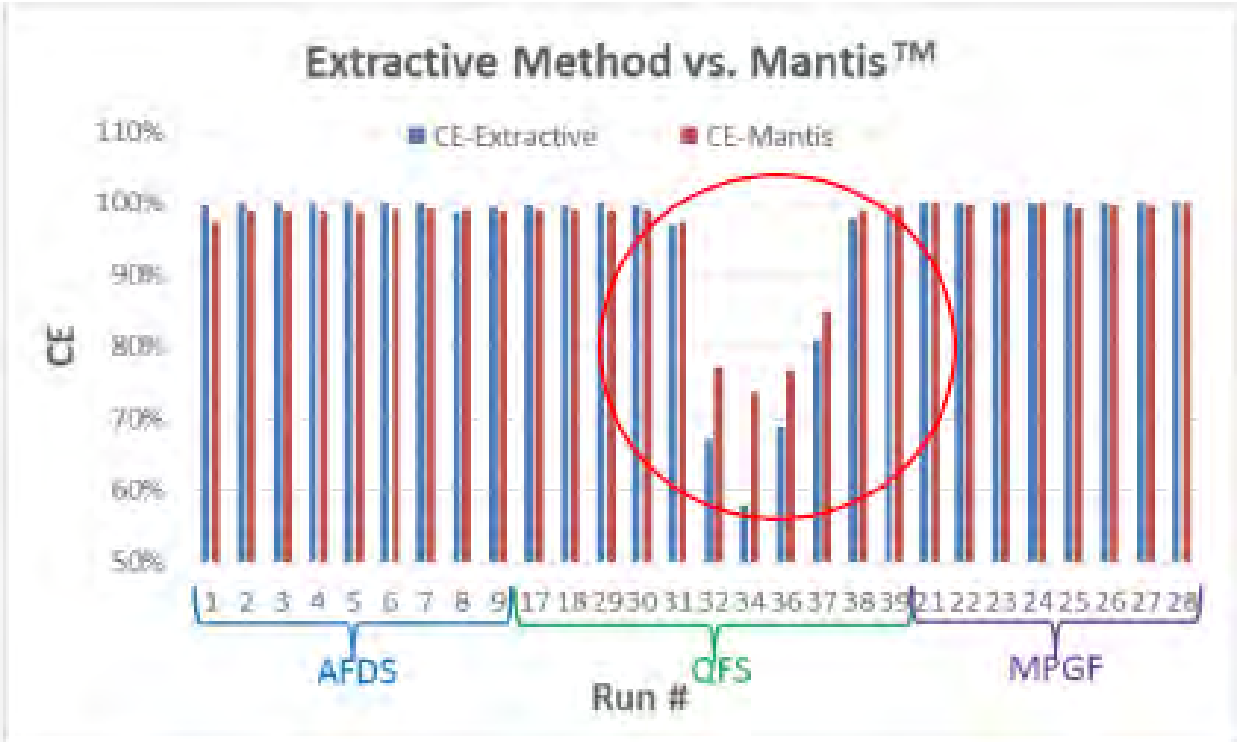
Chemical plants burning natural gas are therefore a particularly inappropriate misuse of AP-42 emission factors – especially one in a river valley that can trap and concentrate emissions in its unique, but currently undefined, meteorological and topographical setting. The application must address this issue of reliability before it is acted on by the Director, which can only be accomplished by confirming the emissions factors through direct testing or other real world evidence.

F. Use of High and Unjustified VOC Destruction Efficiencies for the Flares and Thermal Oxidizers

The application assumes very high destruction efficiencies for both the Flares and Thermal Oxidizers but gives no reliable justification for those values. The Thermal Oxidizers are "assumed" to have a 99.5% VOC destruction efficiency, Amended Appendix C Emission Calculations spreadsheet, BACT analysis p. 17, resulting in a PTE of only 0.14 tpy VOC; no source for this destruction efficiency is provided by the applicant. The flares are assigned a 98% VOC destruction efficiency, BACT analysis, p. 16, resulting in just 4.494 tpy VOC emitted from the HP Flare and 1.947 tpy from the LP Flare. The Director must require justification for these destruction efficiencies and require practically enforceable conditions sufficient to assure that these efficiencies are achieved in operation. It is well known that flare destruction efficiency (and combustion efficiency, a closely related term) depend on many factors, which cannot be controlled in actual operating conditions. See for example, a technical review of flare emissions prepared by EPA.[22] Even when flares have been tested under ideal conditions, their destruction and combustion efficiencies can vary widely.

[22] https://www3.epa.gov/airtoxics/flare/2012flaretechreport.pdf

The chart below is excerpted from some controlled testing done on flares to compare CE using two techniques – extractive sampling and Video Imaging Spectral Radiometry (VISR), using a product called MANTIS.[23]



As the chart shows CE (and DE which closely tracks CE), even under controlled conditions can drop from high values (over 99%) to very low values (55% or so in this case). So, simply assuming that destruction efficiency levels will always be 99% or 98%, as has been done in the proposed flare calculations, is not realistic or feasible.

Compounding the problem, flares are difficult to test using conventional means. So, the permit simply ignores any verification of the flare destruction efficiency. That is unacceptable. We suggest that the permit incorporate newer techniques such as VISR or similar methods In order to confirm, in real time, flare destruction efficiencies for each flare.

[23] https://www.providencephotonics.com/events

G. Use of High and Unjustified Control Efficiency of Fugitive Emissions by LDAR (Leak Detection and Repair)

This chemical plant has a high potential for fugitive releases of VOC emission from leaks, given the miles of pipes and thousands of components (valves, connectors, etc.) required. The applicant itself estimates (using erroneous average emission factors and underestimated numbers of such components, given the preliminary nature of the design as noted in Comment 6) that total uncontrolled releases from all fugitive sources would be 1,395.21 tons of VOCs per year (Appx. C Emission Calculations spreadsheet, FuG_Cracker). However, it then claims that they will release only 44.58 tons/year (or just 3%) of that amount by utilizing a control work practice program called LDAR, the acronym for Leak Detection and Repair. This program involves manually monitoring for these thousands of potential leak locations with handheld equipment and then repairing those leaks following detection. The application assumes a very high level of control of 97% removal efficiency through using the LDAR program.

According to the spreadsheet notes, this control efficiency is taken from a guidance document from the Texas Commission on Environmental Quality setting special conditions for Texas air permits governing fugitive emissions. That guidance document claims a 97% control efficiency for LDAR, but as an "average" factor subject to the problems discussed above for AP-42. Worse, the document provides no explanation for how Texas arrived at this control efficiency or what its reliability may be. Also, the Texas LDAR programs have several weak components such as allowing a full 15 days to repair a leak after detection (Special Condition I), and allowing leaks considered small (emitting less than 500 ppm by volume) to simply be ignored altogether (Special Condition H) in their "28VHP" version program.

The unreliable nature of the TCEQ LDAR program is demonstrated by the TCEQ's chart listing the control efficiencies for all the versions of this program.[24] The last column of the chart indicates that the "Audio/Visual/Olfactory" program of simply walking around looking and smelling for leaks has consistently higher control efficiencies that any of the versions of the LDAR programs.

Control Efficiencies for TCEQ Leak Detection and Repair Programs

[24] Available on TCEQ's web-site at https://www.tceq.texas.gov/assets/public/permitting/air/Guidance/NewSourceReview/control_eff.pdf

Equipment/Service	28M	28RCT	28VHP	28MID	28LAER	Audio/Visual/Olfactory[1]
Valves						
Gas/Vapor	75%	97%	97%	97%	97%	97%
Light Liquid	75%	97%	97%	97%	97%	97%
Heavy Liquid[2]	0%[3]	0%[4]	0%[4]	0%[4]	0%[4]	97%
Pumps						
Light Liquid	75%	75%	85%	93%	93%	93%
Heavy Liquid[2]	0%[3]	0%[3]	0%[5]	0%[6]	0%[6]	93%
Flanges/Connectors						
Gas/Vapor[7]	30%	30%	30%	30%	97%	97%
Light Liquid[7]	30%	30%	30%	30%	97%	97%
Heavy Liquid	30%	30%	30%	30%	30%	97%
Compressors	75%	75%	85%	95%	95%	95%
Relief Valves (Gas/Vapor)	75%	97%	97%	97%	97%	97%
Open-ended Lines[8]	75%	97%	97%	97%	97%	97%
Sampling Connections	75%	97%	97%	97%	97%	97%

The Director should therefore require the facility's fugitive VOC emissions to be monitored in a reliable fashion, followed by quick and effective repairs for any components found to be leaking. At a minimum, this requires more justification for the control effectiveness than the unsupported value assigned by the TCEQ. Using the *ad hoc* TCEQ standard is simply not justified at this massive a plant.

Further, using LDAR to control fugitive emissions is unreliable and technically obsolete. They simply do not work. EPA, in an audit of these types of programs, has noted many deficiencies.[25] These include, among others: not identifying all components; using wrong leak definitions; not following Method 21 properly; failing to monitor the maximum leak location; not monitoring long enough to identify a leak; holding the Method 21 probe too far away from the component; using an incorrect or expired calibration gas; not repairing leaking components within the specific time

[25] https://www.epa.gov/sites/production/files/2014-02/documents/ldarguide.pdf

period; not keeping detailed and/or accurate records; and many others. Basically, the effectiveness of LDAR programs is completely questionable.

LDAR programs are being supplemented or replaced with direct optical imaging programs, also called remote imaging, that are far more efficient at leak detection while also bringing the environmentally significant benefit of quantifying leak emissions. These advantages as a control technology are so substantial that U.S. EPA has included optical gas imaging (OGI) in its NSPS standards for oil and natural gas facilities since 2016, see 40 CFR Part 60, Subpart OOOOa. Considering the massive size of this plant, its location in a confined river valley, and the adoption of optical imaging in the NSPS program, the Director should require OGI at this facility as BACT and as a verification tool for flares (mentioned earlier).

Even industry has recognized that LDAR programs have many deficiencies and that OGI is a superior method (as compared to LDAR) that can be used more effectively to detect the larger leaks (which form the bulk of the emissions) quickly and then focus the repair effort on the larger leakers.[26] This results in a more efficient process, better for the operator and the environment. In fact, the benefits of OGI and its superiority over LDAR in not only detecting but also quantifying emissions have been recognized by industrial companies such as Exxon. Exxon owns IntelliRed, an autonomous gas leak detection system, described as follows:

> The system is designed primarily for process safety applications, but can be used for environmental monitoring and product loss prevention. An IntelliRed™ system includes one or more fixed IR cameras connected to a computer where a sophisticated gas plume recognition algorithm resides. The algorithm constantly processes the images generated by the IR camera, filters out non-gas plume objects or other changes in the scene, and singles out gas plumes that may be present in the scene. When gas plumes are detected, the system automatically sends an alert to designated personnel….IntelliRed™ technology allows real-time gas plume highlighting, with multistage leak confirmations, while filtering out common interferences such as people and vehicles

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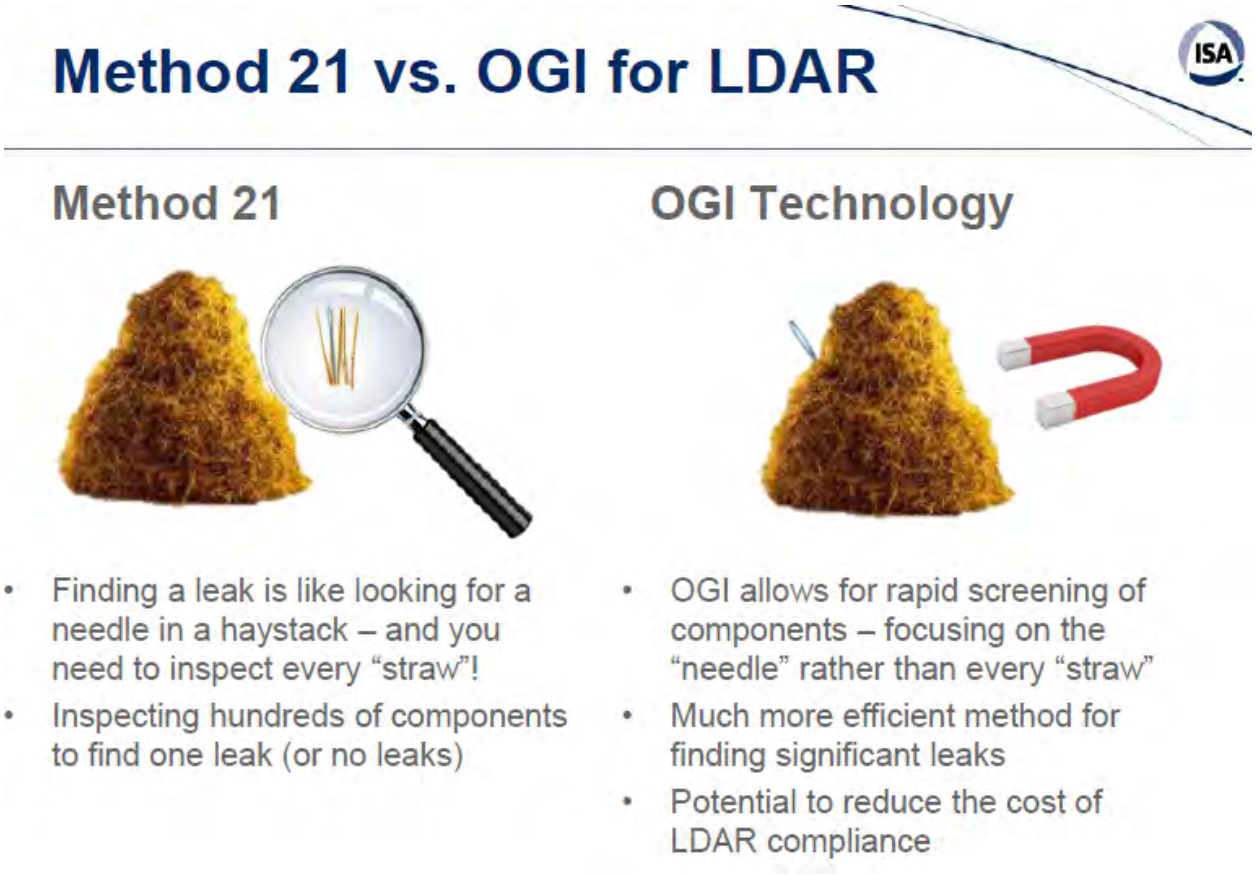
[26] There are many variants of OGI. As a recent paper by Ravikumar, et. al. (http://dx.doi.org/10.1021/acs.est.6b03906) states:

> "The most common OGI technology for methane detection relies on infrared (IR) imaging. A commonly used IR camera creates images of a narrow range of the mid-IR spectrum (3.3−3.4 μm wavelength) which methane and other light hydrocarbons actively absorb. More advanced technologies are under active development. For example, hyperspectral imaging acquires spectrally resolved images, allowing differentiation between different hydrocarbon gas plumes. A related technique called infrared gas-correlation, have been used to quantify leak rates of gases."

- Remotely and autonomously detect hydrocarbon gas leaks at distances up to 500 feet
- Class 1, Division 2 classification and IP67 rating
- Ideal for installation on offshore platforms, drilling rigs, and other hazardous areas where hydrocarbon gases could be present
- Various alarm options available for proactive leak detection and repair[27]

In fact, Exxon staff describe the differences between LDAR and OGI graphically as follows:



The advantages of OGI are obvious. For all of the aforementioned reasons, the permit should incorporate OGI as BACT for fugitive leaks and as a verification tool for flares.

H. Improper Emission Factors for Greenhouse Gas (GHG) Emissions

[27] https://www.providencephotonics.com/leak-detection

The calculation for GHG emissions from the facility is flawed and underestimates the greenhouse gas emissions (GHG) PTE of the facility. In estimating GHG emissions, given that there are at least three major GHG (carbon dioxide, CO_2; methane, CH_4; and nitrous oxide, N_2O), a concept called Global Warming Potential (GWP) was developed to allow comparison of the global warming impacts of these different GHG, specifically how much energy the emissions of unit mass of a gas will absorb *over a given period of time*, relative to the emission of unit mass of CO_2, also called CO_2 equivalence or CO_2e.[28] Utilizing the proper timespan in making this calculation is especially important in determining the impact of chemicals like methane (CH_4) which have a much stronger greenhouse effect than CO_2 but persists in the atmosphere for only about a decade on average.

The flaw in the application is that the time period it uses is a 100-year GWP to calculate CO_2 equivalence and does so using an older value of GWP found in an earlier 2007 Assessment Report (AR) of the Intergovernmental Panel on Climate Change (IPCC). A shorter 20-year GWP is also available and is more appropriate in the current instances, given that the plant life is not intended to be 100 years and that the impacts of methane will be felt most within a decade or two after being emitted. In the 2013 Assessment Report of the IPCC, methane is rated to have a lifetime of 12.4 years with a GWP of 86 over a 20-year GWP but only 34 over a 100-year GWP. Thus, the application's use of a 100-year timespan, rather than 20, causes the GWP for methane to decrease by a factor of approximately 2.5. This methane factor is important at the facility because the natural gas utilized as fuel for its furnaces and boilers is over 96% methane, see Amended Appendix C Emission Calculations spreadsheet for Furnaces. Methane releases are therefore a significant concern for fugitive emissions that are now addressed by only the weak LDAR system described above.

Obviously, the applicant's choice on the GWP time horizon can greatly affect the numerical values it obtained for CO_2 equivalents. To accurately calculate this value for this facility, the Director should require these values to be recalculated on a 20-year GWP, using current values. This will further increase the CO_2e for the facility, already an enormous 1,785,043 tons per year.

[28] see U.S. EPA "Understanding Global Warming Potentials" at https://www.epa.gov/ghgemissions/understanding-global-warming-potentials.

VII. Comment 3: The Permit Lacks Monitoring Requirements Sufficient to Assure Reasonable Compliance with Permit Limits and Assumptions, in Violation of 42 USC 7661c(c).

A. Frequency of Stack Testing is Inadequate to Assure Reasonable Compliance with VOC, PE/PM10/PM2.5, and CO2e Limits

Clean Air Act permits for major sources must including inspection, monitoring, and reporting requirements sufficient "to assure compliance with the permit terms and conditions." 42 USC 7661c(c). Monitoring and reporting requirements for VOC, PE/PM10/PM2.5, and CO2e emissions from the cracking furnaces involve the calculation of these emissions based on gaseous fuel consumed and either an emissions factor or results from the most recent stack test. This makes frequent stack testing essential to ensure these calculations accurately reflect actual emissions of these pollutants and to capture the variabilities in emissions over time. PTTGCA has proposed that stack testing occur only once every five years. This frequency is woefully inadequate and is not sufficient to assure compliance with the limits for VOC, PE/PM10/PM2.5, and CO2e emissions contained in the permit, many of which are hourly limitations. As such, the draft permit violates 42 USC 7661c(c) and 40 CFR Part 64. There is simply no technical basis that a three-hour (or so) stack test conducted once every five years will adequately represent the emissions (and their variability) from that source for the around 43,800 hours in those five years.

It is common and recommended practice for periodic stack tests to be completed at least annually (along with parametric monitoring that can track emission surrogates between stack tests) to ensure accurate "continuous" monitoring and compliance with applicable emissions limits at all times. At a minimum, the permit must require annual stack testing (and continuous parametric monitoring) to assure compliance with VOC, PE/PM10/PM2.5, and CO2e emission limitations as required by 42 USC 7661c(c).

B. The Facility Must Employ Fenceline Monitoring to Assure Compliance with Permit Terms and Conditions.

OAC rule 3745-15-07 makes "the emission or escape into the open air from any source or sources whatsoever, of smoke, ashes, dust, dirt, grime, acids, fumes, gases, vapors , or any other substances or combinations of substances, in such manner or in such amounts as to endanger the health, safety or welfare of the public, or cause unreasonable injury or damage to property" a public nuisance, and prohibits any person from causing, permitting, or maintaining such public nuisance. The draft

permit incorporates OAC rule 3745-15-07 by reference, making its text a term and condition of the permit.[29] But the permit contains no monitoring whatsoever to assure compliance with this permit term and condition, despite such technology being readily available, technologically and economically feasible, and employed by similar facilities in the same geographic region and nationwide. The lack of monitoring sufficient to assure compliance with this permit term and condition violates 42 USC 7661c(c).

Fenceline monitoring enables regulators to monitor what is leaving a Facility and entering the surrounding community and would provide monitoring necessary to assess whether the Facility is complying with its permit condition that it cannot emit gases, vapors, and other substances into the air in such manner and amounts as to endanger the health, safety or welfare of the public. Without fenceline monitoring, there is no monitoring to ensure VOCs from fugitive emissions are not entering the ambient air at levels that will endanger the health, safety, and welfare of the surrounding community.

Fenceline monitoring has been successfully employed by a number of refineries and petrochemical plants over the past several decades. Examples include the Phillips 66 San Francisco Refinery, the Chevron Richmond Refinery in Richmond, California, the Shell Deer Park Refinery and chemical Plant in Deer Park, Texas, and the Flint Hills Resources chemical plant in Port Arthur, Texas. Notably, fenceline monitoring is also planned for the Shell petrochemical facility under construction in the Ohio River Valley in Beaver County, Pennsylvania.

The fenceline monitoring proposed for the Beaver County Shell petrochemical facility was the result of a settlement agreement following the administrative appeal of the facility's air permit. As part of the settlement, Shell agreed to employ fenceline monitoring that includes the use of at least four continuous air monitoring systems (one upwind of the facility and three downwind of the facility), each consisting of a Total Volatile Organic Compound Photo Ionization Detector Analyzer capable of measuring and registering total VOC concentrations on a continuous basis and reducing to 5-minute averages at a minimum detection level of 20 parts per billion by volume

[29] Draft Permit at 11.

(ppbv) and a Summa canister to be deployed when an action level is reached.[30] The Summa canister must be sent to a third-party lab within two days of sample collection and must be replaced with a new canister within 24 hours of deployment.[31]

The fenceline monitoring system in place at the Phillips 66 San Francisco Refinery uses open-path Fourier Transform Infrared (OP-FTIR) configurations on the north and south fencelines of the plant and has been in operation since 1997.[32] The systems monitor twenty-six different compounds at different concentration levels, with a monitoring frequency of five minutes, and they will sound an alarm if a concentration level is exceeded.[33] In addition, the system has a "spectral library" of over 300 chemicals, which it monitors and reports on a monthly basis.[34] The system also provides real-time data that the facility makes available publicly online.[35] The Chevron Richmond Refinery also provides real-time data to the public online, monitoring for benzene, toluene, xylene, hydrogen sulfide, carbon disulfide, ozone, and sulfur dioxide.[36]

The Shell Deer Park facilities installed their fenceline monitoring system as part of a July 2013 consent decree with EPA for Clean Air Act violations.[37] The Deer Park system includes an open-path ambient air monitor to measure and record benzene concentrations in the ambient air at the fence line and a meteorological station to record weather variables simultaneously, both of which monitor on a five-minute frequency. If a "Screening Condition" is triggered, the operator must begin a field investigation within twenty-four hours to identify the source of the emissions.[38]

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[30] Settlement Agreement Between Shell Chemical Appalachia LLC and Clean Air Council and Environmental Integrity Project (August 25, 2017) at Appendix A, 1-3, *available at* https://cleanair.org/wp-content/uploads/Final-Settlement-Agreement-1.pdf.
[31] *Id.*
[32] EPA, *VOC Fugitive Losses: New Monitors, Emission Losses, and Potential Policy Gaps, 2006 International Workshop* D-3 (2006), *available at* http://www.epa.gov/ttnchie1/efpac/documents/wrkshop_fugvocemissions.pdf.
[33] *Id.*
[34] *Id.*
[35] *See* http://www.fenceline.org/rodeo/data.php (last accessed December 5, 2018).
[36] *See* http://www.fenceline.org/richmond/data.php (last accessed December 5, 2018).
[37] *See* EPA, Shell Deer Park Settlement, http://www2.epa.gov/enforcement/shell-deer-park-settlement (last visited Dec 5, 2018).
[38] *See* Consent Decree, App. 2.9, *United States v. Shell Oil Co.*, No. 4:13-cv-2009 (S.D. Tx. July 10, 2013), *available at* http://www2.epa.gov/sites/production/files/2014-07/documents/sdp-cd.pdf.

The fenceline monitoring system maintained by Flint Hills Resources chemical plant is also a result of a settlement with EPA for Clean Air Act violations in March 2014.[39] As part of the consent decree, Flint Hills Resources maintains two fenceline monitoring systems, each equipped with a one-hour gas chromatograph that monitors concentrations of benzene and 1,3-butadiene on an hourly basis, and a fifteen-minute gas chromatograph that monitors benzene concentrations every fifteen minutes.[40] If any of these monitors reach the "Action Level," Flint Hills Resources personnel must conduct an investigation within twenty-four hours to identify the source of the emissions.[41] As part of the investigation, personnel are to contact the LDAR Group for leak detection assistance, and LDAR technicians can assist using their TVA or a FLIRT IR Gas Detection Camera.[42]

Benzene is widely understood to be a risk to human health and is a known human carcinogen via all routes of exposure.[43] To address this risk, U.S. EPA requires fenceline monitoring for benzene for Petroleum Refineries subject to Maximum Achievable Control Technology regulations.[44] EPA has stated that fenceline monitoring is an "improvement in the way fugitive emissions are managed and will provide an extra measure of protection for surrounding communities."[45] The adoption of such technologies by numerous refineries and petrochemical plants demonstrates that this technology is not only achievable, but a readily available and cost-effective technology for managing fugitive emissions that is already being employed in the region.

The draft permit states the PTTGCA Facility will emit 396 tons of VOCs annually (including benzene and other hazardous air pollutants), and as outlined in earlier sections of this comment, there is substantial evidence that these emissions are underestimated. Without requiring a fenceline monitoring system, the permit fails to assure compliance with permit terms and conditions

[39] *See* EPA, Flint Hills Resources, Port Arthur Clean Air Act Settlement, http://www2.epa.gov/enforcement/flint-hills-resources-port-arthur-clean-air-act-settlement (last visited Dec. 5, 2018).
[40] *See* Consent Decree, App. 5.1, at 1, *United States v. Flint Hill Resources Port Arthur, LLC*, No. 1:14CV169 (E.D. Tx. March 20, 2014).
[41] *Id.*, App. 5.1, at 2-3.
[42] *Id.*, App. 5.1, at 3.
[43] EPA, Petroleum Refinery Fenceline Monitoring Stakeholder Engagement, Webinar for EJ Groups, Fenceline Communities and the Public (June 22, 2016), *available at* https://www.epa.gov/sites/production/files/2016-06/documents/community_webinar_june_2016.pdf (last visited Dec 5, 2018).
[44] Petroleum Refinery Sector Risk and Technology Review and New Source Performance Standards, 80 Fed. Reg. 75177 (Dec. 1, 2015).
[45] *Id.*

prohibiting the facility from releasing substances or combinations of substances in such amounts as to endanger the health, safety or welfare of the public, in violation of 42 USC 7661c(c).

VIII. Comment 4: The Draft Permit Contains Numerous Unenforceable Limitations and Standards, in Violation of 42 USC 7661c(a).

The Clean Air Act is clear that major source permits "*shall* include *enforceable* emission limitations and standards." 42 USC 7661c(a). Yet, many of the standards and limits in the draft permit lack the specificity necessary to be enforceable as a practical or legal matter.

As just one example, the draft permit includes numerous emissions limitations and standards based on mode of operation. The definitions of these operating modes lack precise parameters and do not reflect actual operations of a Facility of this type and magnitude. For example, "startup" and "shutdown" as these terms are commonly understood are misnomers in the context of a petrochemical plant, where startup and shutdown are routine and frequent occurrences and better described as a part of normal operations since they are integral to the operation of such plants. By carving out exceptions for these modes of operating and vaguely defining them or not defining them at all, the draft permit makes many limits and standards in the permit unenforceable.

The definition of "startup" in the draft permit allows this operating mode to continue for 24 hours at a time for each furnace and defines the mode as existing from the time fuel is introduced to the furnace to when the SCR catalyst bed reaches its "stable operating temperature"—which is not defined. This places no limit on how frequently the furnaces may be in startup mode nor does it provide specific parameters for what constitutes stable operating temperature or how to assess when this temperature has been reached. Similarly, the draft permit defines "shutdown" as the time period from when the SCR catalyst bed first drops below its stable operating temperature to when fuel is removed from the furnace, again providing no enforceable parameters for identifying when this mode is actually occurring. There is no time limitation on how long a furnace may operate in shutdown mode. The definition of "normal operations" states it is when all six furnaces are operating in parallel and about 65% of ethane feed is converted to ethylene and its derivatives. As discussed in earlier sections of this Comment, PTTGCA's application applies specific assumptions based on operating mode. Accordingly, all assumptions used in the application for each operating mode should be included as enforceable parameters in the definition for that operating mode that is contained in the draft permit.

Together, the operating mode definitions create significant ambiguity as to what definition will apply to a given set of actual operations. This is unacceptable given that many of the permit limits apply only to certain operating modes. For example, for the ethane cracking furnaces, the rolling 12-month average limit for NOx and the hourly maximum limit for NOx both exclude periods of startup, shutdown, and hot steam standby. The lack of specific parameters to define operating modes makes these critical limits in practice unenforceable, as the operator has immense flexibility to argue the furnaces were operating in a mode exempt from the emissions limit. This is particularly concerning given the likelihood that the facility will violate NOx standards, and the NOx hourly maximum limitation in particular, as detailed in earlier sections of this comment. The lack of enforceability created by poorly defined operating modes is a violation of 42 USC 7661c(a).

The draft permit's use of vague and undefined terminology to the degree it renders some limitations and standards unenforceable is not limited to issues with operating modes, but also extends to those permit limits and standards invoking BACT, where the BACT for a given source and pollutant is defined without specificity, but instead using terms such as "proper design," "good combustion practices," and "energy efficient combustion," all of which lack the clear (i.e., quantitative) parameters necessary for enforcement. The permit must include enforceable emission limitations and standards for every input and assumption relied upon in PTTGCA's application.

IX. Comment 5: The BACT/BAT Analyses are Consistently Flawed.

The applicant is required to undertake a BACT analysis pursuant to Ohio Adm. Code §3745-31-15(C) providing that "The owner or operator of a new major stationary source shall apply BACT to the major stationary source for each regulated NSR pollutant that the major stationary source would have the potential to emit in significant amounts." The proposed facility is a major source for the NSR regulated pollutants NOx, CO, VOC, and all species of PM, see Application, Appx. D-1, BACT Analysis, p. 1. This appendix correctly states that this analysis must be made pursuant to U.S. EPA's five-step "top-down" BACT procedure and that Ohio EPA requires a similar "top-down" analysis. The applicant's summary of the BACT requirements on p. 4 of the appendix is accurate in its emphasis that the BACT analysis must adopt the most stringent control technology available unless its rejection is clearly justified:

> US EPA and OEPA have interpreted the BACT requirement as containing two core criteria. First, the BACT analysis must include consideration of the most stringent available technologies (i.e., those that provide the "maximum degree of emissions reduction"). Second, any decision to determine BACT as a control alternative that is less effective than the most stringent available must be justified by an analysis of objective indicators showing that the more stringent alternative(s) are unreasonable or otherwise not achievable.

These fundamental BACT requirements have not been complied with in the application. There are two general and widespread failures. First, multiple BACT assessments require the use of work practices that are vague and thus cannot insure maximum stringency of controls. An example is the GHG emission control for the steam boilers described on page 32 of the Staff Determination prefacing the draft permit which describes the proposed BACT as including "[g]ood combustion and operating practices" consisting of "sufficient residence time to guarantee efficient operations," and "properly controlled excess air and sufficient turbulence to support the optimum combustion condition, combustion control system to optimize the oxygen and air flow to maximize fuel efficiency," as well as following the manufacturer's maintenance practices. The vagueness of phrases such as "sufficient," "properly," and "optimize" render them unenforceable. While the applicant proposed a "holistic" BACT limit for CO_2e of 117 lb/MMBtu for the combined effects of its proposed energy efficiency measures, this limit cannot be considered the most stringent when the work practices remain essentially undefined.

Second, multiple sources are given merely the standards set in the New Source Performance Standards (NSPS) (e.g., Cooling Tower VOC, Process Vents PM) or National Emission Standards for Hazardous Air Pollutants (NESHAP) (e.g., Process Wastewater VOC) without consideration of any more stringent standard which would also be economically cost-effective. As many of these standards are years or decades old, consideration of more modern and more stringent technologies should have been undertaken.

Finally, when specific control technology is required, there are two examples where the top-down analysis was flawed, i.e., the use of a 90% control efficiency for the Selective Catalytic Reduction (SCR) for NOx control of the Cracking Furnace emissions, and the use of LDAR to control fugitive emissions from leaks.

A. SCR Control Efficiency

The use of SCR for NOx control for the Cracker Furnaces is an acceptable choice of technology, but the limitation of just a 90% control efficiency (Draft Permit, p. 24) is not justified and was not supported by a proper BACT analysis. The 90% figure reflects the applicant's statement in Table 5-5 on page 49 of Appendix D-1 that the "Typical Overall Control Efficiency" of SCR is "70 – 90%." This reference to "typical" control efficiency is not relevant to determining the strictest level of control at this particular source that a proper BACT analysis is designed to determine. The use of the 90% figure is particularly unwarranted given the unique benefit of SCR technology that its efficiency can be improved to very high levels well above 90%, for example, by the addition of more catalyst. Many examples exist of SCR control efficiencies of 95% and higher. Setting the proper control efficiency in a BACT analysis is a design and cost issue determined by plotting a graph of more catalyst for greater efficiency against increasing cost. The optimal point on this graph for setting BACT is where diminishing returns in greater efficiency no longer justify continued increases in cost. To undertake this analysis requires a cost review as provided in Step 4 of the five-step top-down BACT process. However, no such cost analysis was performed to determine the proper level of control, and the BACT analysis is fundamentally flawed as a result. This failure may be substantial, as a control efficiency of 95% for the SCR, which is not uncommon, would cut the furnaces' NOx emissions in half. Accordingly, the draft permit cannot be approved by the Director until a valid cost estimate for SCR efficiency is undertaken and the control efficiency selected is justified.

B. Fugitive Emission Control.

The plant is a massive potential source of Fugitive VOC emissions through equipment leaks. The applicant estimates that, if uncontrolled, total releases from all fugitive sources would be 1,395.21 tons of VOCs annually (Appx. C Emission Calculations spreadsheet, FuG_Cracker). These fugitive emissions will include hazardous air emissions and the potent GHG methane. The BACT analysis concludes that the proper control technology for this program is a Leak Detection and Repair (LDAR) program. According to the BACT analysis, Section 14, LDAR was chosen after a review of the RBLC database which "reveals that the *primary* control strategy is an effective" LDAR program to control VOCs from equipment leaks (emphasis added). As it has been used for decades, it is not surprising that it is the most often used, primary control, but that is irrelevant to BACT which seeks the most stringent control. As previously stated in Comment 1 on Modeling, LDAR is a highly unreliable technology with a technically unsupported control efficiency and

multiple provisions that limit its stringency, such as allowing an extended period of time between leak detection and repair. As also stated in Comment 1, the use of direct optical imaging (OGI) is a more reliable system and should be deemed BACT for fugitive emissions control at this plant.

In Section 14 of its BACT analysis for equipment leaks, the applicant lists optical imaging as a potential control technology although it refers to it as "remote sensing technology such as infrared camera," but rejects it during its top-down analysis, see Tables 14-3 and 14-4. It rejects optical imaging for three reasons: 1) that remote sensing using infrared cameras are not effective in quantifying the amount and concentration of a leak; 2) it cannot identify individual chemicals in a gas mixture; and 3) it is technically infeasible as operators need special training and are not commonly available. None of these reasons are credible for two compelling reasons.

First, all three claimed problems are also inherent problems in LDAR. LDAR cannot directly quantify leaks, cannot identify their constituents, and requires operator training. Thus, even if these claims against optical imaging were true, they do not provide a basis for selecting LDAR over optical imaging. Second, the claimed limitations on optical imaging are no longer true, as they are based on dated references that do not reflect the current state of the technology. The applicant cites two sources for its criticism of optical imaging from 1995 and 2011, when optical imaging was not nearly as well-developed as it is today.

Attached as Appendix 2 to these comments is a PowerPoint presentation from the 2015 LDAR symposium, an industry workgroup, entitled "New Optical Gas Imaging Technology for Quantifying Fugitive Emission Rates," co-authored by ExxonMobil researchers. The presentation establishes that optical gas imaging is a more efficient method for finding significant leaks and has the potential to reduce the cost of Method 21 LDAR compliance. Slide 14 discloses a relatively new accessory device that can by attached to the infrared detection camera that can quantify and report the mass leak rate (in lb/hr). This technology is superior to Method 21 LDAR as it directly measures emission rates compared to Method 21's estimation process that has a significant error potential (slides 7-13).

Because the applicant's rejection of optical imaging was based on false conclusions, the BACT analysis should be redone to determine whether optical imaging, either alone or supplemented by a Method 21 program, should be deemed BACT. For this massive a chemical plant located within

a confined river valley, fugitive emission of VOCs is a serious public health issue that deserves BACT consideration based on contemporary information.

X. Comment 6: Many Critical Source Characteristics are Identified as "Subject to Change" with No Provision for How Final Characteristics are to be Incorporated into the Permit.

The Air Emission Inventory, Appendix C to the application, relies on fundamental design data governing the emissions sources which form the basis for calculating their PTE. However, the information for many of the facility's sources are identified in the Inventory as in some way preliminary and subject to change. Thus, many of the PTE calculations for the plant may change when final data is presented.

For example, page 25 of the Inventory addressing the HDPE Unit Process Vent Particulate Emissions Estimates contains nineteen (19) separate emissions sources, all of which qualified by the statement: "rates estimated based on preliminary licensor information." Similarly, page 29, on ECU fugitive emission calculations, states in the second footnote, "Component counts derived from preliminary design estimates for ECU equipment." This same preliminary design footnote is then repeated on page 30, on fugitive emissions from the HDPE equipment, and on page 32, for OSBL fugitive emissions. Similarly, on page 36, where the flaring emissions calculation during MSS (maintenance, start-up, shut-down) operations are presented, the first footnote states, "VOC mass flaring rates are based on preliminary vendor data associated with various potential scenarios (e.g., a cold-startup)."

Obviously, a PSD permit cannot be issued based on critical preliminary design (and emissions) data that is subject to change. The Director, therefore, cannot issue a permit on this facility until final information is provided in an amended application.

XI. Conclusion

For the reasons set forth herein, the Commenters ask Ohio EPA to not approve PTTGCA's PTI. Regulators must do their due diligence to hold industrial interests accountable to the people who bear the burden of hosting a major air pollution source in their community. Ohio EPA has clearly not fulfilled its regulatory oversight duties in issuing this draft PTI, and, at the very least, it should

remedy the clear legal deficiencies described in this Comment. The Commenters further emphasize that increased petrochemical development and fossil fuel production has no place in Ohio at a time when immediate action is needed to address the catastrophic threats of climate change.

Respectfully Submitted,

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Appendix 1

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23 November 2016

Via Email and U.S. Mail
Kristin Vanecko
Site Coordinator
Ohio EPA Southeast District Office
Division of Environmental Response and Revitalization
2195 Front Street
Logan, OH 43138-8637

RE: Ohio EPA's Review of the Voluntary Action Program (VAP) No Further Action (NFA) Letter for FirstEnergy R.E. Burger Power Plant, 16NFA666; Initial Notice of Deficiency and Reviewer Comments

Dear Ms. Vanecko:

ERM on behalf of FirstEnergy Corp., has prepared the following response to Ohio EPA's Review of the Voluntary Action Program (VAP) No Further Action (NFA) Letter for FirstEnergy R.E. Burger Power Plant, 16NFA666; Initial Notice of Deficiency and Reviewer Comments, received on November 8, 2016.

Once Ohio EPA has reviewed this response, ERM will finalize the documents and will submit the NFA Letter Addendum and execute the Environmental Covenant.

Issue A: OAC 3745-300-13 – No Further Action Letter Content and Procedures

Comment 1:
Under "Areas of Known or Suspected Contamination", the discussion of Identified Area 5B refers to the BUSTR Closure Assessment Report and states that it is included in Appendix B. It is not clear that this refers to Appendix B of the Phase II Report. Since this level of detail is not needed for the executive summary for filing, please remove the reference to the BUSTR report and submit a revised executive summary for filing.

Comment 1 Response:
The reference to the BUSTR report has been deleted, as presented in the attached revised executive summary for filing.

Comment 2:
The Summary of Receptors and Pathways table in Section 3.1 of the detailed executive summary does not list receptors for each pathway. Receptors are not identified for direct contact with soils pathway and the

inhalation of volatile organic compounds in indoor air pathway. Please provide an updated table with the response to comments.

Comment 2 Response:
The table has been updated and now identifies the Site and Construction worker receptors for these pathways as presented below and is attached.

Receptor / Pathway	On or off property	Current or reasonably anticipated?
Site and Construction Worker/Direct Contact (i.e., dermal contact, incidental ingestion, and inhalation of particulate emissions) with soils	*On Property*	*Current and Reasonably Anticipated*
Ecological Receptors – groundwater to surface water pathway for human and ecological receptors	*On Property*	*Current and Reasonably Anticipated*
Construction Worker/Inhalation of VOCs volatilizing from groundwater to outdoor air in excavation trenches	*On Property*	*Current and Reasonably Anticipated*
Site Worker/Inhalation of VOCs in indoor air that migrate from groundwater and soil (future development scenario)	*On Property*	*Current and Reasonably Anticipated*

Comment 3:
In the detailed executive summary, the third and fourth paragraphs of Section 3.1 Groundwater refer to sections 3.2, 6.0 and 7.0, but it is not clear in which report these sections are located. Please provide a response to this comment clarifying where these sections are located.

Comment 3 Response:
The reference to section 3.2, has been changed to "3.3 of this NFA Letter" as follows.

"As presented in Section 3.3 of this NFA Letter, the PSRA demonstrates the following:"

The reference to sections 6.0 and 7.0 has included a reference to the Phase II PA as follows.

"As indicated in Table 1 (Appendix G), although direct contact with on-Property groundwater through ingestion or dermal contact is not complete for the Property, an evaluation of groundwater data for potential potable use is provided in Sections 6.0 and 7.0 of the Phase II PA as required by the VAP."

Comment 4:
Section 7.0 of the detailed executive summary cites the rule effective August 1, 2014 for the definition of industrial land use and identifies the rule as OAC 3745-300-08(C)(2)(c)(iii). Please provide the correct rule citation and the correct effective date of the rule in a response to this comment, OAC 3745-300-08(C)(2)(c) effective 5/26/2016.

Comment 4 Response:
The NFA Letter has been revised to the correct rule citation and effective date as follows:

"To meet applicable VAP standards, the following activity and use limitation, as described in the environmental covenant, will be as follows:

- The Property will be restricted to industrial land use only, as defined in OAC 3745-300-08(C)(2)(c) (effective May 26, 2016)."

Issue B: OAC 3745-300-11 - Remediation – Environmental Covenant

Comment 1: Edits to EC language

Edits are needed to clarify and finalize the environmental covenant language consistent with the criteria of ORC 5301.82 and OAC 3745-300-13(E)(8)(e)(ii) (EC content). Adjustments are required to account for information reviewed in the NFA letter and recent changes to the EC template.

Comment 2: Email revised draft EC to Ohio EPA; include final EC draft in addendum

Ohio EPA's staff attorney, Clint White, e-mailed the draft environmental covenant with suggested edits to the Volunteer's legal counsel. Once revised to reflect the items discussed above, e-mail the revised draft environmental covenant as a Word document to Mr. White, at clint.white@epa.ohio.gov, for his further review. Include the draft environmental covenant in the addendum that the certified professional issues to amend the NFA letter in accordance with OAC 3745-300-13(E).

Comments 1 and 2Response:

The EC has been revised in accordance with recent template changes. The revised draft EC is attached.

ERM believed we have adequately addressed these comment and appreciate Ohio EPA's assistance on this project. Let us know if you have any further questions or comments.

Regards,

Daniel M. Bremer, CP#*311*
Environmental Resources Management, Inc.

cc: Martin Smith, Ohio EPA
Anthony Skicki, FirstEnergy Corp.
Jason Speicher, FirstEnergy Corp.
Jeff Hassen, ERM

Attachments:

- Executive Summary For Filing
- The Summary of Receptors and Pathways Table in Section 3.1
- Revised Environmental Covenant
- CP Affidavit

EXECUTIVE SUMMARY FOR FILING

Property/subject of the NFA letter: The Former FirstEnergy R.E. Burger Power Plant

Alias Property Names: N/A

[Property Address or describe location]: 57246 Ferry Landing Road, Shadyside (Belmont County), Ohio

Volunteer(s): FirstEnergy Generation LLC. and Ohio Edison Company

76 South Main, Akron, Ohio 44308

Property Owner(s): FirstEnergy Corp.

76 South Main, Akron, Ohio 44308

NFA Letter and Executive Summary Issued by: Daniel M. Bremer, VAP Certified Professional, CP#311, Environmental Resources Management (ERM), 3333 Richmond Road, Suite 160, Beachwood, Ohio 44122

216-593-5211

The following is an executive summary of a No Further Action (NFA) letter for the above mentioned property. This executive summary serves as the recording document to meet the requirements of Ohio Revised Code (ORC) 3746.14(A)(1) and Ohio Administrative Code (OAC) 3745-300-13(J) under Ohio's Voluntary Action Program (VAP). Copies of the NFA letter and request for Covenant Not to Sue (CNS) may be obtained by contacting the Ohio EPA – Division of Environmental Response and Revitalization, Central Office Records Management Officer at (614) 644-2924. A legal description of the approximately 167.696-acre property is included in the NFA letter.

Historical Uses of the Property

Prior to the 1940s, the Property was undeveloped land or developed for agricultural and residential use. The Property was first developed for industrial use in 1942 when the Power Plant was built. The Property was operated as a fossil fuel generation electric power plant from 1942 until 2012. The Power plant began operation in 1944 as a single-unit, 63-megawatt fossil fuel generation plant. A second 63-megawatt unit was added in 1947, followed by a 103-megawatt unit in 1950 and two 156-megawatt units in 1955. The Burger units collectively produced 568 megawatts of electricity.

Units 1 and 2 were the first to retire in 1995, when they reached the end of their life cycle.

FirstEnergy permanently shut down two fossil fuel generation -fired units, Units 4 and 5, at the Property in 2010. The units were included in the 2005 Consent Decree settlement with the U.S. EPA, and FirstEnergy had the option to re-power, install scrubbers, or shut down the units as part of an effort to reduce the company's sulfur dioxide emissions.

Unit 3 was shut-down in 2011. Demolition of the Power Plant was initiated in the summer of 2015 and will be complete by the end of 2016.

Areas of Known or Suspected Contamination

Number of areas on this property that have known or suspected contamination:**12**

Identified Area 1: Former Ash Pond

The former ash pond located west of the former Power Plant received rinse water used to clean ash from plant equipment, fly and bottom ash from coal burning, and ash slurry. The pond is also reported to have received water from several floor drains in the plant. There is potential for elevated arsenic, mercury, and other metal concentrations in soil and groundwater associated with the ash and for Volatile Organic Compounds (VOCs) and polycyclic aromatic hydrocarbons (PAHs) from petroleum products associated with the Power Plant operations.

Identified Area 2: Former Coal Pile Area

The former coal pile is located in the eastern portion of the Property adjacent to the Ohio River. Coal for the Power Plant was stored on the ground surface and outdoors for nearly 70 years. Metals and PAHs from stored coal and PCBs from the crusher area transformers may have affected underlying soil and groundwater.

Identified Area 3: Former Historic Settling Ponds

The historical settling pond, formerly used for facility floor wastewater, is located east of the former ash pond. The nature and complete historical use of this area is unknown, making it a potential area of concern. The settling pond immediately west of the Power Plant received storm water and untreated process water from floor drains in the maintenance building area. Based on the nature of historical operations in this area of the Property, metals, VOC, and SVOC impacts to soil and groundwater are possible.

Identified Area 4: Former Boneyard Area

At the time of the initial and subsequent Property visits, the "boneyard" area located northwest of the Power Plant contained stockpiled equipment belonging to both FirstEnergy and Power Span. The nature and historical use of this area are unknown, making this area a potential concern for soil and groundwater impacts from metals, VOCs, and PAH.

Identified Area 5: Former Power Plant Area

- **Identified Area 5A: Former Transformer Area**

Several transformers surrounding the Power Plant were observed to have oil-stained soil at their bases during Phase I PA site visits. Furthermore, the Property contact indicated these transformers formerly contained Polychlorinated Biphenyl (PCB) oils that were once serviced at the facility. Historically, oils have been spilled and impacted soils removed. Therefore, there is a potential for metals and PCB impacts to underlying soil and ground water from these transformers.

- **Identified Area 5B: Petroleum Underground Storage Tanks**

The Power Plant formerly maintained three 25,000 gallon diesel USTs. The age and integrity of these USTs is not known, and therefore, there is a potential for a release of VOCs, PAHs, petroleum hydrocarbons from the USTs to impact surrounding environmental media. These UST removals were completed on January 28, 2016 and the Ohio State Fire Marshall Bureau of Underground Storage Tank Regulations (BUSTR) No Further Action (NFA) Status for Release #7000112-N00003 was documented in a letter to FirstEnergy dated April 13, 2016.

- **Identified Area 5C: Oil Storage and Fuel Oil AST Storage Area**

An oil storage area (containing drums of various petroleum products) and associated oil stained soil, as well as numerous ASTs were observed along the eastern side of the Power Plant. The age and integrity of these ASTs is unknown, and oil-stained soil was observed during Phase I PA activities. Therefore, there is potential for a historical release of VOCs, PAHs, and metals to have impacted underlying soil and groundwater.

- **Identified Area 5D: Ohio Edison Substations**

Two substation yards are located north of the main FE Power Plant buildings. The eastern yard, which was partially active during the initial site visits and was utilized by Ohio Edison, and the second western yard, was inactive. The substation yards have been demolished during 2016. Transformers and equipment within the substations could have historically contained PCB oils. Therefore, the potential existed for PCB impacts to the underlying soils.

- **Identified Area 5E: Power Plant Maintenance Building**

A maintenance building related to equipment repairs for the main Power plant. Historic operations conducted in the maintenance buildings may have resulted in metals, VOC, PAH and PCB impacts to underlying soils.

Identified Area 6: Maintenance Building Area

- **Identified Area 6A: Historic Maintenance Operations**

Historic operations conducted in the maintenance buildings may have resulted in metals, VOC, and PAH impacts to underlying soil and groundwater.

- **Identified Area 6B: Current and Historic USTs**

A former heating oil UST was abandoned in-place and is located beneath the maintenance building. In addition, one UST used to store heating oil is located east of the maintenance buildings. A release from this UST could have resulted in VOC, SVOC, and petroleum hydrocarbon impacts to surrounding soil and/or groundwater. The approximately 15,000 gallon heating oil UST was removed on April 26, 2016 and sampling results are included in this Phase II PA report. Additionally a septic tank is also located south of the maintenance buildings.

A release from the fuel oil UST and septic tank may have resulted in VOC, PAHs, and metals impacts to surrounding soil and ground water.

Identified Area 7: Northern Property

The northern portion of the Property has historically been undeveloped. However, there is a potential that fill material may be present and the potential exists for the historical storage and/or disposal of process related wastes and equipment.

An ash landfill area, approximately two acres in size previously adjoined the northern portion of the Property to the west, north of the sand and gravel impoundment. The ash landfill was removed and hauled off-site for disposal during the summer and fall of 2015. This area is not owned by F.E., but formerly the potential existed for contaminants to migrate from the fly ash area to this IA on the Property. However, given the current status of this area, it likely no longer poses a potential environmental concern.

Are there any impacts to the property from another source?

☒ No, all contamination on or emanating from this property originated from this property above applicable standards.

☐ Yes, contamination from an off-property source has impacted this property

If yes, provide a brief explanation:

Are there any known impacts from this property to surrounding properties or waterways?

☐ No, contamination has not migrated off-property above applicable standards.

☒ Yes, the groundwater point of compliance at the Property is the Ohio River and in accordance with *OAC 3745-300-08(G)(2)* groundwater samples from monitoring wells at the Property were compared with the outside mixing zone average (OMZA) surface water criteria. All surface water results are below the OMZA aquatic life criteria, indicating that these sample locations are in compliance with VAP standards.

Sediment samples exceeded screening benchmarks for some metals, but these metals are not likely to be bioavailable (based on AVS-SEM analysis) and therefore risk to aquatic life is negligible.

Remedies Implemented to Ensure Property is Safe for Reuse

☒ Asbestos abatement – Explain: Regulated asbestos containing materials were removed by a license asbestos abatement contractor and handled and disposed in accordance with applicable laws prior to and during the demolition activities that occurred at the property in 2015 and 2016. All structures have been demolished and are no longer present on the Property.

☒ Property use restrictions – Explain: Land use will be deed restricted to Industrial use only and groundwater will be restricted to industrial use with no potable groundwater use.

☐ Remedies subject to ongoing operation and maintenance (O&M), for example, under an O&M Plan Explain: N/A

☐ Risk mitigation measures for construction or excavation activities – Explain: N/A

☒ Other remedial activities – Explain: No remedial activities were needed. However a limited soil excavation was completed within IA-2 in an effort to reduce risk. Applicable standards were met using a calculated soil direct contact risk of 1E-04 risk level for industrial property use.

Contamination Remaining on the Property

The following contamination remains on the property but has been determined to meet applicable standards for the safe reuse of the property for its intended land use:

☒ Soil – No COCs are present in soils on the Property at concentrations above VAP GDCS for C/I land use or C/E activities, with the exception of the following:

- Surface samples located in IA-2 SW-5, SW-6, SW-7, SW-8, SW-3(10) and SW-4(10) exceeded the 5.8 mg/kg GDCS of C/I use for benzo(a)pyrene, with a detections ranging from 8.8 to 24 mg/kg.
- Arsenic exceedances of the 77 mg/kg GDCS of C/I where detected in 0-2 foot soil samples at the locations of IA-1-MW-5 (110 mg/kg), IA-1-SB-5 (120 mg/kg), IA-3-SB-10 (88 mg/kg), and IA-3-SB-11 (91 mg/kg).

Based on Property Specific Risk Assessment (PSRA) calculations remaining soils do not pose an unacceptable risk. The cumulative risk ratio is equivalent to a cumulative cancer risk in IA-1 was determined to be 6×10^{-5}. Consistent with OAC 3745-300-09(B)(1), for industrial property land use, the cumulative carcinogenic risk must not exceed an upper bound lifetime risk to an individual of 1×10^{-4} provided that the cumulative cancer risk to off-property receptors is less than 1×10^{-5}.

☒ Soil gas –Based on the results of the PSRA, supplemental soil gas samples were deemed necessary to evaluate low concentrations of volatile compounds detected in some soil samples collected during the Phase II PA. Consistent with Ohio EPA VAP rules, the cumulative risk ratios were calculated for the soil gas data collected in each IA. Soil gas samples were collected in IA-5A/IA-5E – Power Plant, Former Transformer Area and Maintenance Shop Area and in PSRA Table 13 for IA-5C – Power Plant, Oil Storage and Fuel Oil AST Area.

When compared to the target exterior soil gas concentrations calculated using the U. S. EPA VISL calculator, the cumulative risk ratios are well below the target benchmark of 1.0 and the cumulative cancer risks are within acceptable levels. As such, there is no unacceptable risk to human health via the vapor intrusion pathway for future industrial property use.

☒ Ground water – Dissolved results indicated that elevated metals are present in the groundwater samples analyzed from only monitoring wells MW-12 and MW-13 during the February 2015 and only MW-13 during the September 2015 event at concentrations above UPUS. UPUS exceedances were not detected in the groundwater samples analyzed from any of the deeper monitoring wells at the Property with the exception of cobalt at estimated concentrations in MW-12D and MW-13D.

The groundwater point of compliance at the Property is the Ohio River and in accordance with *OAC 3745-300-08(G)(2)* groundwater samples from monitoring wells at the Property were compared with the outside mixing zone average (OMZA) surface water criteria. Metal concentrations in the dissolved fraction of groundwater exceeded OMZA benchmarks in monitoring wells MW-10, MW-11, MW-12, and MW-13.
All surface water results collected during the Phase II PA are below the OMZA aquatic life criteria, indicating that these sample locations are in compliance with VAP standards.

Sediment samples were collected during the Phase II PA at levels exceeding screening benchmarks for some metals, but these metals are not likely to be bioavailable (based on AVS-SEM analysis) and therefore risk to aquatic life is negligible.

☒ Other (if applicable) – Explain: Surface water and sediment samples were collected from the Ohio River along the Property. All surface water results are below the OMZA aquatic life criteria, indicating that these sample locations are in compliance with VAP standards. Sediment samples exceeded screening benchmarks for some metals, but these metals are not likely to be bioavailable (based on AVS-SEM analysis). Based on data analyses, none of the sediment sample locations were likely to result in toxicity and therefore there is no potential for unacceptable risk to aquatic life.

The Property Assessment and Cleanup Supports the Following Allowable Land Uses

☒ Industrial use

The Summary of Receptors and Pathways table in Section 3.1 of detailed executive summary.

Receptor / Pathway	On or off property	Current or reasonably anticipated?
Site and Construction Worker/Direct Contact (i.e., dermal contact, incidental ingestion, and inhalation of particulate emissions) with soils	*On Property*	*Current and Reasonably Anticipated*
Ecological Receptors – groundwater to surface water pathway for human and ecological receptors	*On Property*	*Current and Reasonably Anticipated*
Construction Worker/Inhalation of VOCs volatilizing from groundwater to outdoor air in excavation trenches	*On Property*	*Current and Reasonably Anticipated*
Site Worker/Inhalation of VOCs in indoor air that migrate from groundwater and soil (future development scenario)	*On Property*	*Current and Reasonably Anticipated*

To be recorded with Deed Records - ORC § 317.08

ENVIRONMENTAL COVENANT

This Environmental Covenant is entered into by each of FirstEnergy Generation, LLC ("FEG") and Ohio Edison Company ("OE") as to the Property described in Section 2 below ("the Property") owned by it, and the Ohio Environmental Protection Agency ("Ohio EPA") pursuant to Ohio Revised Code ("ORC") §§ 5301.80 to 5301.92 for the purpose of subjecting the Property to the activity and use limitation set forth herein.

This Environmental Covenant requires current and future Property owners to meet certain requirements, including, but not limited to:

- Comply with the activity and use limitations given by paragraph 5 below that restricts the land use for the Property to industrial use only, and prohibits groundwater extraction for any potable use.
- Noncompliance with any activity and use limitation will result in the covenant not to sue issued for the Property by the Director of Ohio EPA to be void on and after the date of the noncompliant use, as described in paragraph 7 below.
- Provide an annual compliance report to Ohio EPA by December 1st of each year beginning the year after the effective date of this Environmental Covenant, as required by paragraph 9 below, describing that the Property continues to be used in compliance with the activity and use limitations.
- Give notice to new property owners (also known as "Transferees") upon conveyance, as required by paragraph 10 below, of the activity and use limitations and the recorded location of this Environmental Covenant.
- Notify Ohio EPA within 10 days of each conveyance, as required by paragraph 10 below, of the property that was conveyed and new owner's contact information.

WHEREAS, FEG has undertaken a voluntary action with respect to the Property under Ohio's Voluntary Action Program ("VAP"), pursuant to ORC Chapter 3746 and Ohio Administrative Code ("OAC") Chapter 3745-300.

WHEREAS, a portion of the Property is owned by FEG and a portion of the Property is owned by OE, as set forth in Section 3 below.

WHEREAS, the voluntary action remedy for the Property includes the activity and use limitation set forth in this Environmental Covenant. Certified Professional Mr. Dan Bremer, CP #311, issued a no further action letter ("NFA Letter") for the Property on October 11, 2016, and submitted the NFA Letter to Ohio EPA (16NFA666) with a request for a covenant not to sue.

WHEREAS, the activity and use limitation supports the issuance of the NFA Letter and a covenant not to sue for the Property; the limitation protects against exposure to the hazardous substances in soil on or underlying the Property.

WHEREAS, the Property uses or may in the future use an engineering control to comply with applicable standards, as the terms are defined in OAC Chapter 3745-300. Whenever an engineering control is used, an activity and use limitation in this Environmental Covenant requires the engineering control implementation, through an operation and maintenance (O&M) agreement, until it is no longer needed to meet applicable standards. An engineering control that is no longer needed may be modified or terminated in accordance with OAC 3745-300-11 and applicable O&M plan and agreement criteria. The documentation must be submitted to and accepted by Ohio EPA prior to any modification or termination.

WHEREAS, the NFA Letter's executive summary contains an overview of the voluntary action. The executive summary may be reviewed as an exhibit to the covenant not to sue issued for the Property, recorded in the deed records for the Property in the Belmont County Recorder's Office. The covenant not to sue and the NFA Letter may also be reviewed by contacting the Records Management Officer for the Division of Environmental Response and Revitalization, at Ohio EPA's Central Office, 50 West Town Street, Columbus, OH 43216, 614-644-2924, or at Ohio EPA's Southeast District Office at 2195 Front Street, Logan, Ohio 43138, 740-385-8501 or by contacting the Owner, FirstEnergy Corp., 76 South Main Street, Akron, OH 44308, 610-921-6908.

Now therefore, FEG, OE and Ohio EPA agree to the following:

1. Environmental Covenant. This instrument is an environmental covenant developed and executed pursuant to ORC §§ 5301.80 to 5301.92.

2. Property. This Environmental Covenant concerns a total of approximately 167.696 acres located at 57246 Ferry Landing Road, Shadyside, 43947-9700 in Belmont County Ohio (collectively, the "Property"), consisting of the following parcels

(each a "Parcel") and more particularly described in Attachment 1 attached hereto and incorporated by reference herein:

Parcel 1: an approximately 130.577-acre tract of real property being Belmont Count tax parcels currently numbered PPN 15-90017.000 and 15-90018.001 (130.577 acres), owned by FEG;

Parcel 2: an approximately 32.367-acre tract of real property being Belmont County tax parcels currently numbered 15-90014.000 and 15-90018.002 (32.367 acres) owned by FEG; and

Parcel 3: an approximately 4.753-acre tract of real property being Belmont County parcel currently numbered 15-90018.0000 (4.752 acres) owned by OE.

A map of the Property boundary is included in Attachment 2 and incorporated by reference herein.

3. Owner. Parcels 1 and 2 of the Property are owned by FirstEnergy Generation, LLC, 76 South Main Street, Akron, OH 44308. Parcel 3 of the Property is owned by Ohio Edison Company, 76 South Main Street, Akron, OH 44308.

4. Holder. Pursuant to ORC § 5301.81, the holder of this Environmental Covenant ("Holder") as to each Parcel of the Property is the respective Owner of such Parcel as listed in Section 3 above.

5. Activity and Use Limitation. As part of the voluntary action remedy described in the NFA Letter, each Owner hereby imposes and agrees to comply with the following activity and use limitations with respect to the Parcel or Parcels owned by such Owner as listed in Section 3 above:

Limitation for Industrial Land Use.

The Property is hereby restricted to industrial land use only, as defined in OAC 3745-300-08(C)(2)(c) (effective May 26, 2016).

Industrial land use is "land use with potential exposure of adult workers during a business day and potential exposures of adults and children who are visitors to industrial facilities during the business day. Industrial land use has potential exposure of adults to dermal contact with soil, inhalation of vapors and particles

from soil and ingestion of soil and inhalation of volatile compounds due to vapor intrusion to indoor air." Industrial land use includes, without limitation, the following uses that are ancillary and incidental to industrial land use, such as office use, laboratory use, employee eating areas and cafeterias and related kitchens, medical/first aid/first responder areas, employee recreation areas (indoor and outdoor), logistic/transportation handling areas and a visitor's center.

Prohibition on Ground Water Extraction for Potable Use.

No person shall extract or use ground water at or underlying the Property for any potable purpose.

Engineering Control Implementation

For each engineering control used to meet applicable standards, the control shall be operated and maintained in compliance with an Ohio EPA-approved operation and maintenance plan or agreement applicable to the control. This limitation applies to any engineering control used to meet applicable standards regardless of time, whether put in place before or after the execution of this Environmental Covenant.

Any noncompliant control implementation shall be corrected within the plan-specified timeframe or, in case of no specified timeframe, within a reasonable time as determined by Ohio EPA.

For purposes of ORC 3746.05, the Property use shall not be considered in noncompliance with this limitation when the noncompliance is with an engineering control and is (i) corrected within a reasonable time under an operation and maintenance plan or agreement, (ii) returned to compliance by a timeline specified by an Ohio EPA notice of noncompliance, or (iii) cured under a compliance schedule agreement entered into pursuant to ORC 3746.12 with the Ohio EPA director.

An engineering control or its use may be modified or terminated following Ohio EPA approval of a demonstration made, in accordance with OAC 3745-300-11 and applicable operation and maintenance plan and agreement criteria, that supports the control use is no longer needed to comply with applicable standards.

6. Running with the Land. This Environmental Covenant shall be binding upon the Owner, during the time that the Owner owns the Property or any portion thereof, and upon all assigns and successors in interest, including any Transferee, and shall run with the land, pursuant to ORC § 5301.85, subject to amendment or termination as set forth herein. The term "Transferee", as used in this Environmental Covenant, shall mean any future owner of any interest in the Property or any portion thereof, including, but not limited to, owners of an interest in fee simple, mortgagees, easement holders, and/or lessees.

7. Compliance Enforcement. Compliance with this Environmental Covenant may be enforced pursuant to ORC § 5301.91, and other applicable law. Failure to timely enforce compliance with this Environmental Covenant or the activity and use limitations contained herein by any party shall not bar subsequent enforcement by such party and shall not be deemed a waiver of the party's right to take action to enforce against any non-compliance. Nothing in this Environmental Covenant shall restrict the Director of Ohio EPA from exercising any authority under applicable law. Pursuant to ORC § 3746.05, if the Property or any portion thereof is put to a use that does not comply with any activity and use limitation set forth in paragraph 5 above, the covenant not to sue issued for the Property by the Director of Ohio EPA under ORC § 3746.12 is void on and after the date of the commencement of the noncompliant use.

8. Rights of Access. Each Owner hereby grants to Ohio EPA's authorized representatives the right of access to the Parcel or Parcels of the Property owned by it for implementation or enforcement of this Environmental Covenant and shall require such access as a condition of any transfer of the Property or any portion thereof.

9. Compliance Reporting. Each Owner or Transferee, if applicable, shall annually submit to Ohio EPA written documentation verifying that the activity and use limitation set forth herein with respect to the Parcel or Parcels of the Property owned by it remains in place and is being complied with. Documentation shall be due to Ohio EPA on December 1st of each year beginning the year after the effective date of this Environmental Covenant, unless otherwise directed by Ohio EPA.

10. Notice upon Conveyance. Each instrument hereafter conveying any interest in the Property or any portion thereof shall contain a notice of the activity and use limitation set forth in this Environmental Covenant, and provide the recorded location of this Environmental Covenant. The notice shall be substantially in the following form:

THE INTEREST CONVEYED HEREBY IS SUBJECT TO AN ENVIRONMENTAL COVENANT, RECORDED IN THE DEED OR OFFICIAL RECORDS OF THE BELMONT COUNTY RECORDER ON _____, 2016, IN [DOCUMENT ____, or BOOK___, PAGE ____]. THE ENVIRONMENTAL COVENANT CONTAINS THE FOLLOWING ACTIVITY AND USE LIMITATION:

Limitation for Industrial Land Use.

The Property is hereby restricted to industrial land use only, as defined in OAC 3745-300-08(C)(2)(c) (effective May 26, 2016).

Industrial land use is "land use with potential exposure of adult workers during a business day and potential exposures of adults and children who are visitors to industrial facilities during the business day. Industrial land use has potential exposure of adults to dermal contact with soil, inhalation of vapors and particles from soil and ingestion of soil and inhalation of volatile compounds due to vapor intrusion to indoor air." Industrial land use includes, without limitation, the following uses that are ancillary and incidental to industrial land use, such as office use, laboratory use, employee eating areas and cafeterias and related kitchens, medical/first aid/first responder areas, employee recreation areas (indoor and outdoor), logistic/transportation handling areas and a visitor's center.

Prohibition on Ground Water Extraction for Potable Use.

No person shall extract or use ground water at or underlying the Property for any potable purpose.

Engineering Control Implementation

For each engineering control used to meet applicable standards, the control shall be operated and maintained in compliance with an Ohio EPA-approved operation and maintenance plan or agreement applicable to the control. This limitation applies to any engineering control used to meet applicable standards regardless of time, whether put in place before or after the execution of this Environmental Covenant.

Any noncompliant control implementation shall be corrected within the plan- specified timeframe or, in case of no specified timeframe, within a reasonable time as determined by Ohio EPA.

For purposes of ORC 3746.05, the Property use shall not be considered in noncompliance with this limitation when the noncompliance is with an engineering control and is (i) corrected within a reasonable time under an operation and maintenance plan or agreement, (ii) returned to compliance by a timeline specified by an Ohio EPA notice of noncompliance, or (iii) cured under a compliance schedule agreement entered into pursuant to ORC 3746.12 with the Ohio EPA director.

An engineering control or its use may be modified or terminated following Ohio EPA approval of a demonstration made, in accordance with OAC 3745-300-11 and applicable operation and maintenance plan and agreement criteria, that supports the control use is no longer needed to comply with applicable standards.

Owner or Transferee, if applicable, shall notify Ohio EPA within ten (10) days after each conveyance of an interest in the Property or any portion thereof owned by it. The notice shall include the name, address, and telephone number of the Transferee, a copy of the deed or other documentation evidencing the conveyance, and a survey map that shows the boundaries of the property being transferred.

11. Representations and Warranties. Each Owner hereby represents and warrants to the other signatories hereto, with respect to the Parcel or Parcels of the Property owned by such Owner:

A. that such Owner is the sole owner of the Parcel or Parcels of the Property identified in Section 2 above as being owned by it;

B. that such Owner holds fee simple title to the Property and that such Owner conducted a current title search that shows that the Parcel or Parcels of the Property owned by such Owner are not subject to any interests or encumbrances that conflict with the activity and use limitation set forth in this Environmental Covenant;

C. that such Owner has the power and authority to enter into this Environmental Covenant, to grant the rights and interests herein provided and to carry out all obligations hereunder;

D. that this Environmental Covenant will not materially violate or contravene or constitute a material default under any other agreement, document or instrument to which such Owner is a party or by which such Owner may be bound or affected;

E. that such Owner has identified all other persons that own an interest in or hold an encumbrance on the Parcel or Parcels of the Property owned by such Owner, and, if applicable, notified such persons of such Owner's intention to enter into this Environmental Covenant.

12. Amendment or Termination. This Environmental Covenant may be amended or terminated by consent of all of the following: the applicable Owner, as to the Parcel or Parcels of the Property owned by such Owner, or a Transferee, if applicable; and the Director of the Ohio EPA, pursuant to ORC §§ 5301.82 and 5301.90 and other applicable law. The term "Amendment," as used in this Environmental Covenant, shall mean any changes to the Environmental Covenant, including the activity and use limitation set forth herein. The term "Termination," as used in this Environmental Covenant, shall mean the elimination of all activity and use limitations set forth herein and all other obligations under this Environmental Covenant.

This Environmental Covenant may be amended or terminated only by a written instrument duly executed by the Director of Ohio EPA and by the Owner or Transferee, if applicable, of the Property or any portion thereof, as applicable. Within thirty (30) days of signature by all requisite parties on any amendment or termination of this Environmental Covenant, the Owner or Transferee, if applicable, shall file such instrument for recording with the Belmont County Recorder's Office, and shall provide a file- and date-stamped copy of the recorded instrument to Ohio EPA.

13. Severability. If any provision of this Environmental Covenant is found to be unenforceable in any respect, the validity, legality, and enforceability of the remaining provisions shall not in any way be affected or impaired.

14. Governing Law. This Environmental Covenant shall be governed by and interpreted in accordance with the laws of the State of Ohio.

15. Recordation. Within thirty (30) days after the date of the final required signature upon this Environmental Covenant, Owner shall file this Environmental Covenant for recording, in the same manner as a deed to the Property, with the Belmont County Recorder's Office.

16. Effective Date. The effective date of this Environmental Covenant shall be the date upon which the fully executed Environmental Covenant has been recorded as a deed record for the Property with the Belmont County Recorder's Office.

17. Distribution of Environmental Covenant. The Owner shall distribute a file- and date-stamped copy of the recorded Environmental Covenant to Ohio EPA.

18. Notice. Unless otherwise notified in writing by any party hereto or Ohio EPA, any document or communication required by this Environmental Covenant shall be submitted to:

As to Ohio EPA:

Ohio EPA – Central Office
Division of Environmental Response and Revitalization
50 West Town Street
Columbus, Ohio 43216
Attn.: DERR Records Management Officer, regarding 16NFA666

Or, send electronically to: records@epa.ohio.gov

And

Ohio EPA – Southeast District Office
2195 Front Street
Logan, Ohio 43138
Attn.: DERR Site Coordinator for 16NFA666

As to Owner:

FirstEnergy Generation, LLC
Ohio Edison Company
c/o FirstEnergy Corp.

76 South Main Street
Akron, Ohio 44308
Attn: Mr. Ketan K. Patel, Vice President

The undersigned represents and certifies that the undersigned is authorized to execute this Environmental Covenant.

[REMAINDER OF PAGE INTENTIONALLY LEFT BLANK - SIGNATURE PAGE FOLLOWS]

IT IS SO AGREED:

Owner:

FirstEnergy Generation, LLC

By: _____
Ketan K. Patel, Vice President

Ohio Edison Company

By: _____
Ketan K. Patel, Vice President

State of Ohio)
) ss:
County of Summit)

Before me, a notary public, in and for said county and state, personally appeared Ketan K. Patel, Vice President of FirstEnergy Generation, LLC an Ohio limited liability company, and Ohio Edison Company, an Ohio Corporation (collectively, "Owner"), who is a duly authorized representative of the Owner, who acknowledged to me the execution of the foregoing instrument on behalf of the Owner.

IN TESTIMONY WHEREOF, I have subscribed my name and affixed my official seal this _____ day of _____, 2016.

_____
Notary Public

OHIO ENVIRONMENTAL PROTECTION AGENCY

_____
Craig W. Butler, Director

State of Ohio)
) ss:
County of Franklin)

Before me, a notary public, in and for Franklin County, Ohio, personally appeared Craig W. Butler, the Director of Ohio EPA, who acknowledged to me that he did execute the foregoing instrument on behalf of Ohio EPA.

IN TESTIMONY WHEREOF, I have subscribed my name and affixed my official seal this _____ day of _____, 2016.

_____
Notary Public

This instrument was prepared by:

NAME OF ERM CONSULTANT WHO PREPARED THE DOCUMENT (DOES NOT NEED TO BE AN ATTORNEY)

Daniel M. Bremer, CP#311
3333 Richmond Road
Suite160
Beachwood, OH 44122

Clint R. White
Ohio EPA Legal Office
50 West Town Street, Suite 700
Columbus, OH 43216

Attachment 1

Legal Description of the Property

FirstEnergy Generation Corp. - 130.577 acre tract, South of Railroad

Situated in the Township of Mead, County of Belmont, and State of Ohio and being part of the Southwest Quarter of Section 29, and part of the Southeast Quarter of Section 35, (R-2 West, T-1 North) of the Old Seven Ranges, and further known as being land conveyed to FirstEnergy Generation Corp. as recorded in O.R. 34, Page 781 of the Belmont County Recorder's Office, described as follows:

Beginning at the Northwesterly corner of said Section 29, thence South 01 degrees 18 minutes 36 seconds West along the westerly line of said Section 29 a record distance of 3371.49 feet to 5/8 inch rebar with cap set on the southerly limited access right of way line of State Route 872, also referred to as 154.55 feet right of S.R.7 centerline tangent Station 436+80.68 TL; thence the following 7 (seven) courses along the southerly Limited Access Right Way Line of said State Route 872 ramp right of way;

South 86 degrees 03 minutes 22 seconds East a distance of 57.26 feet to a 5/8 inch rebar with cap marked 6456 found; South 46 degrees 17 minutes 51 seconds East a distance of 176.94 feet to a 5/8 inch rebar with cap marked 6456 found; South 59 degrees 57 minutes 01 seconds East a distance of 135.39 feet to a 5/8 inch rebar with cap marked 6456 found; South 70 degrees 18 minutes 04 seconds East a distance of 164.15 feet to a 5/8 inch rebar with cap marked 6456 found; South 88 degrees 53 minutes 44 seconds East a distance of 42.77 feet to a 5/8 inch rebar with cap marked 6456 found 168.29 feet right of SR 872 centerline Station 17+96.80TL of said SR 872, recorded in Plat Cabinet D, Slide 294 of the Belmont County Recorder's Office; South 88 degrees 53 minutes 44 seconds East a distance of 532.34 feet to a 5/8 inch rebar with cap marked 6456 found; North 51 degrees 51 minutes 20 seconds East a distance of 139.88 feet to a 5/8 inch rebar with cap marked 6456 found 60 feet right of SR 872 centerline Station 24+32.04 on the northwesterly line of the Ohio Valley Railroad Company/ POV and C Railroad Company as recorded on Deed Volume 7, Page 210 of the Belmont County Recorder's Office, a variable width railroad right of way; thence South 87 degrees 07 minutes 31 seconds East along the southerly line of S.R. 872 a distance of 123.81 feet to a 5/8 inch rebar with cap set and the **true point of beginning;**

Thence 266.98 feet along the arc of a curve deflecting to the left having a radius of 2525.53 feet, a delta angle of 06 degrees 03 minutes 25 seconds, and a chord bearing North 35 degrees 08 minutes 29 seconds East with a chord distance of 266.86 feet to a mag nail set on the southerly line T.R. 533, a 60 foot public right of way;

thence South 69 degrees 53 minutes 01 seconds East a distance of 305.26 feet to a 5/8 inch rebar with cap set;

thence South 01 degrees 18 minutes 36 seconds West along the westerly line of a parcel of land now or formerly conveyed to Arlin Corp. by Deed Volume 538, Page 416 of the Belmont County Recorder's Office a distance of 315.45 feet to a 5/8 inch rebar with cap set;

thence South 88 degrees 39 minutes 24 seconds East along the southerly line of said Arlin Corp. a distance of 294.75 feet to a point where said line intersects the low water mark of 1896 of the Ohio River as the same existed prior to the erection of the United States Government dam, also the easterly line of Belmont County, Ohio, and the westerly line of Marshall County, West Virginia;

thence the following eleven (11) courses along the meandering of the Ohio River as the same existed prior to erection of said United States Government dam;

South 08 degrees 51 minutes 32 seconds West a distance of 287.50 feet;

South 18 degrees 16 minutes 11 seconds West a distance of 500.00 feet;

South 27 degrees 41 minutes 11 seconds West a distance of 600.00 feet;

South 44 degrees 26 minutes 11 seconds West a distance of 300.00 feet;

South 52 degrees 41 minutes 11 seconds West a distance of 350.00 feet;

South 66 degrees 26 minutes 11 seconds West a distance of 250.00 feet;

South 78 degrees 41 minutes 11 seconds West a distance of 550.00 feet;

North 87 degrees 03 minutes 49 seconds West a distance of 1119.82 feet;

North 80 degrees 18 minutes 49 seconds West a distance of 408.25 feet;

North 71 degrees 18 minutes 49 seconds West a distance of 740.00 feet;

North 58 degrees 48 minutes 49 seconds West a distance of 1037.50 feet to a point on the westerly line of the grantor;

Thence North 01 degrees 10 minutes 01 seconds East a distance of 815.72 feet to a 5/8 inch rebar with cap set, witnessed by an "x" on a disk in a monument box found North 01 degrees 10 minutes 01 seconds East at a distance of 24.37 feet;

thence South 60 degrees 58 minutes 13 seconds East along the southerly line of land now or formerly conveyed to P.O.V. & C. Railroad Company by Deed Volume 272, Page 530 of the Belmont County Recorder's Office a distance of 199.65 feet to a 5/8 inch rebar with cap set;

thence along the southerly line land now or formerly conveyed to P.O.V. & C. Railroad Company by Deed Volume 7, Page 210 of the Belmont County Recorder's Office (Ohio Valley Railroad, Penna Railroad, or Conrail), a Railroad right of way with a curve turning to the left with an arc length of 634.13 feet, a radius of 1945.08 feet, with a chord bearing of South 70 degrees 18 minutes 36 seconds East, with a chord length of 631.33 feet to a 5/8 inch rebar with cap set;

thence North 10 degrees 21 minutes 01 seconds East continuing along the southerly line of said Railroad a distance of 10.00 feet to a 5/8 inch rebar with cap set;

thence South 79 degrees 38 minutes 59 seconds East a distance of 902.02 feet to a 5/8 inch rebar with cap set;

thence continuing along the southerly line of said Railroad with a curve turning to the left with an arc length of 770.42 feet, a radius of 2516.12 feet, with a chord bearing of South 88 degrees 25 minutes 17 seconds East, with a chord length of 767.42 feet a 5/8 inch rebar with cap set;

thence continuing along the southerly line of said Railroad South 01 degrees 20 minutes 20 seconds West a distance of 5.06 feet to a 5/8 inch rebar with cap set;

thence continuing along the southerly line of said Railroad with a curve turning to the left with an arc length of 96.52 feet, a radius of 2521.12 feet, a chord bearing of North 81 degrees 43 minutes 53 seconds East, with a chord length of 96.51 feet to a 5/8 inch rebar with cap set;

thence continuing along the southerly line of said Railroad with a curve turning to the left with an arc length of 585.95 feet, with a radius of 2485.53 feet, with a chord bearing of North 73 degrees 52 minutes 52seconds East, with a chord length of 584.59 feet, to a 5/8 inch rebar with cap set on the westerly line of a 4.500 acre parcel;

thence the following twenty six (26)courses along said 4.500 acre parcel:

South 10 degrees 01 minutes 55 seconds East a distance of 419.90 feet to a 5/8 inch rebar with cap set;

South 79 degrees 58 minutes 05 seconds West a distance of 149.15 feet to a 5/8 inch rebar with cap set;

South 35 degrees 26 minutes 10 seconds West a distance of 13.83 feet to a 5/8 inch rebar with cap set;

South 09 degrees 53 minutes 57 seconds East a distance of 183.53 feet to a 5/8 inch rebar with cap set;

North 80 degrees 06 minutes 03 seconds East a distance of 40.51 feet to a point;

South 09 degrees 53 minutes 57 seconds East a distance of 40.61 feet to a 5/8 inch rebar with cap set;

North 79 degrees 09 minutes 09 seconds East a distance of 113.56 feet to a point;

South 09 degrees 58 minutes 39 seconds East a distance of 50.35 feet 5/8 inch rebar with cap set;

North 80 degrees 01 minutes 30 seconds East a distance of 109.29 feet to a mag nail set;

North 09 degrees 56 minutes 34 seconds West a distance of 77.39 feet to a 5/8 inch rebar with cap set;

North 79 degrees 56 minutes 26 seconds East a distance of 335.59 feet to a 5/8 inch rebar with cap set;

South 11 degrees 44 minutes 11 seconds East a distance of 22.41 feet to a point witnessed by a mag nail set 2 feet on the prolongation thereof;

North 80 degrees 59 minutes 37 seconds East a distance of 33.95 feet to a 5/8 inch rebar with cap set;

North 09 degrees 56 minutes 59 seconds West a distance of 22.46 feet to a 5/8 inch rebar with cap set;

North 79 degrees 44 minutes 17 seconds East a distance of 50.78 feet to a 5/8 inch rebar with cap set;

North 09 degrees 43 minutes 55 seconds West a distance of 143.36 feet to a 5/8 inch rebar with cap set;

North 87 degrees 54 minutes 01 seconds West a distance of 15.59 feet to a point;

North 02 degrees 05 minutes 59 seconds East a distance of 3.98 feet to a 5/8 inch rebar with cap set;

South 79 degrees 57 minutes 20 seconds West a distance of 376.84 feet 5/8 inch rebar with cap set;

North 10 degrees 00 minutes 19 seconds West a distance of 19.54 feet to a mag nail set;

North 57 degrees 26 minutes 01 seconds West a distance of 52.58 feet to a 5/8 inch rebar with cap set;

South 79 degrees 58 minutes 05 seconds West a distance of 55.71 feet to a 5/8 inch rebar with cap set;

North 10 degrees 01 minutes 55 seconds West a distance of 349.13 feet to a 5/8 inch rebar with cap set;

along the arc of a curve turning to the right with an arc length of 65.94 feet, with a radius of 50.00 feet, with a chord bearing of North 27 degrees 44 minutes 48 seconds East, with a chord length of 61.26 feet to a 5/8 inch rebar with cap set;

along the arc of a curve turning to the left with an arc length of 1205.79 feet, with a radius of 2525.53 feet, with a chord bearing of North 51 degrees 50 minutes 51 seconds East, with a chord length of 1194.37 feet to the **point of beginning.**

The above described tract contains 130.577 acres of land of which 68.846 acres are contained within Section 35, and 61.731 acres are contained within Section 29 as surveyed by Timothy J. Briggs, PS 7495 in July of 2005 and updated by James P. Yurkschatt, PS 7809 of Campbell and Associates in August of 2016. 1.089 acres is encompassed within ODOT Parcel 12WR of State Route 872, Project No. BEL-872-0.00(Section 35). Basis of bearings is assumed. 5/8 inch rebar 30 inches long with cap marked "C&A" set unless noted.

FirstEnergy Generation Corp. - 32.367 acre tract, North of Railroad

Situated in the Township of Mead, County of Belmont, and State of Ohio and being part of the Southwest Quarter of Section 29, R-2 West, T-1 North of the Old Seven Ranges, and further known as being part of a parcel of land now or formerly conveyed to FirstEnergy Generation Corp. as recorded in O.R. 34, Page 781 of the Belmont County Recorder's Office, described as follows:

Beginning at the Northwesterly corner of said Section 29, thence South 01 degrees 18 minutes 36 seconds West along the westerly line of said Section 29 a record distance of 3371.49 feet to 5/8 inch rebar with cap set on the southerly limited access right of way line of State Route 872, said point also referred to as being 154.55 feet right of S.R.7 centerline tangent Station 436+80.68 TL and the **true point of beginning;**

thence the following 5 (five) courses along the southerly Limited Access Right Way Line of State Route 872 (ramp) right of way;

South 86 degrees 03 minutes 22 seconds East a distance of 57.26 feet to a 5/8-inch rebar with cap marked 6456 found;

South 46 degrees 17 minutes 51 seconds East a distance of 176.94 feet to a 5/8 inch rebar with cap marked "6456" found;

South 59 degrees 57 minutes 01 seconds East a distance of 135.39 feet to a 5/8 inch rebar with cap marked "6456" found;

South 70 degrees 18 minutes 04 seconds East a distance of 164.15 feet to a 5/8 inch rebar with cap marked "6456" found;

South 88 degrees 53 minutes 44 seconds East a distance of 42.77 feet to a 5/8 inch rebar with cap marked "6456" found 168.29 feet right of SR 872 centerline Station 17+96.80TL of said SR 872, recorded in Plat Cabinet D, Slide 294 of the Belmont County Recorder's Office;

thence South 36 degrees 23 minutes 00 seconds East along the southerly line of said State Route 872 a distance of 209.26 feet to a 5/8 inch rebar with cap marked "6456" found;

thence South 76 degrees 46 minutes 02 seconds East continuing along the southerly line of said State Route 872 a distance of 229.10 feet to a 5/8 inch rebar with cap marked "6456" found on the northerly line of said P.O.V. Railroad;

thence with a curve turning to the right with an arc length of 1306.90 feet, a radius of 2425.53 feet, a chord bearing of South 65 degrees 11 minutes 56 seconds West with a chord length of 1291.15 feet to a 5/8 inch rebar with cap set;

thence with a curve turning to the right with an arc length of 85.29 feet, a radius of 2461.12 feet, a chord bearing of South 81 degrees 37 minutes 38 seconds West, with a chord length of 85.29 feet to a 5/8 inch rebar with cap set;

thence South 01 degrees 37 minutes 55 seconds West a distance of 5.06 feet to a 5/8 inch rebar with cap set;

thence with a curve turning to the right with an arc length of 431.69 feet, a radius of 2466.12 feet, with a chord bearing of South 87 degrees 38 minutes 56 seconds West with a chord length of 431.14 feet to a 5/8 inch rebar with cap marked "6456" found marking the Southeast corner of land conveyed to Dennis D. Hendershot as recorded in O.R. 314, Page 381 of the Belmont County Recorder's Office;

thence North 01 degrees 17 minutes 55 seconds East, along the Est line of said Hendershot land, a distance of 1607.18 feet to a 5/8 inch rebar with cap marked "6456" found marking the Northeast corner thereof;

thence South 39 degrees 06 minutes 43 seconds East a distance of 294.55 feet to a 5/8 inch rebar with cap marked "6456" found;

thence South 49 degrees 27 minutes 32 seconds East a distance of 425.37 feet to a 5/8 inch rebar with cap marked "6456" found;

thence South 73 degrees 11 minutes 18 seconds East a distance of 150.37 feet to a 5/8 inch rebar with cap marked "6456" found;

thence South 86 degrees 03 minutes 22 seconds East a distance of 151.60 feet **to the point of beginning.**

The above described tract contains 32.367 acres of land of which 9.735 acres are contained within Section 29 and 22.632 acres are contained within Section 35 as surveyed by Timothy J. Briggs, PS 7495 in July of 2005 and updated by James P. Yurkschatt, PD 7809 of Campbell and Associates in August of 2016. Basis of bearings is assumed. 5/8 inch rebar 30 inches long with yellow plastic cap marked "C&A" set unless noted.

Ohio Edison Company – 4.752 acre tract (Substation)

Situated in the Township of Mead, County of Belmont, and State of Ohio and being part of the Southwest Quarter of Section 29, R-2 West, T-1 North of the Old Seven Ranges, and further known as being part of a parcel of land now or formerly conveyed to the Ohio Edison Company as recorded in Deed Volume 264, Page 371 of the Belmont County Recorder's Office, described as follows:

Beginning at the Northwesterly corner of said Section 29, thence South 01 degrees 18 minutes 36 seconds West along the westerly line of said Section 29 a record distance of 3371.49 feet to 5/8 inch rebar with cap set on the southerly limited access right of way line of State Route 872, said point also referred to as being 154.55 feet right of S.R.7 centerline tangent Station 436+80.68 TL; thence the following 7 (seven) courses along the southerly Limited Access Right Way Line of State Route 872 ramp right of way;

South 86 degrees 03 minutes 22 seconds East a distance of 57.26 feet to a 5/8 inch rebar with cap marked 6456 found; South 46 degrees 17 minutes 51 seconds East a distance of 176.94 feet to a 5/8 inch rebar with cap marked "6456" found; South 59 degrees 57 minutes 01 seconds East a distance of 135.39 feet to a 5/8 inch rebar with cap marked "6456" found; South 70 degrees 18 minutes 04 seconds East a distance of 164.15 feet to a 5/8 inch rebar with cap marked "6456" found; South 88 degrees 53 minutes 44 seconds East a distance of 42.77 feet to a 5/8 inch rebar with cap marked "6456" found 168.29 feet right of S.R. 872 centerline Station 17+96.80TL of said SR 872, recorded in Plat Cabinet D, Slide 294 of the Belmont County Recorder's Office; South 88 degrees 53 minutes 44 seconds East a distance of 532.34 feet to a 5/8 inch rebar with cap marked "6456" found; North 51 degrees 51 minutes 20 seconds East a distance of 139.88 feet to a 5/8 inch rebar with cap marked "6456" found 60 feet right of S.R. 872 centerline Station 24+32.04 on the northerly line of the Ohio Valley Railroad Company/ POV and C Railroad Company as recorded on Deed Volume 7, Page 210 of the Belmont County Recorder's Office(Ohio Valley Railroad, Penna Railroad, or Conrail), a variable width railroad right of way; thence South 87 degrees 07 minutes 31 seconds East along the southerly line of S.R. 872 a distance of 74.60 feet to a 5/8 inch rebar with cap set and the **true point of beginning;**

thence along the easterly line of said railroad 282.68 feet along the arc of a curve turning to the left having a radius of 2485.53 feet, a chord bearing of North 35 degrees 34 minutes 01 seconds East, with a chord length of 282.53 feet to a 5/8 inch rebar with cap set on the southerly line of T.R. 533, a 60 foot public right of way;

thence South 69 degrees 53 minutes 01 seconds East along the southerly line of said T.R. 533 a distance of 40.91 feet to a mag nail set;

thence 1472.77 feet along the arc of a non-tangential curve turning to the right a radius of 2525.53 feet, with a chord bearing of South 48 degrees 49 minutes 08 seconds West, with a chord length of 1451.99 feet to 5/8 inch rebar with cap set set;

thence southwesterly 65.94 feet along the arc of a curve deflecting to the left having a radius of 50.00 feet, a delta angle of 75 degrees 33 minutes 25 seconds, a chord length of 61.26 feet, and a chord bearing of South 27 degrees 44 minutes 48 seconds West to a 5/8 inch rebar with cap set;

thence South 10 degrees 01 minutes 55 seconds East a distance of 349.13 feet to a 5/8 inch rebar with cap set;

thence the following 21 courses along the outside of a chain link fence:

thence North 79 degrees 58 minutes 05 seconds East a distance of 55.71 feet to a 5/8 inch rebar with cap set;

thence South 57 degrees 26 minutes 01 seconds East a distance of 52.58 feet to a mag nail set;

thence along a fence South 10 degrees 00 minutes 19 seconds East a distance of 19.54 feet to a to a 5/8 inch rebar with cap set;

thence North 79 degrees 57 minutes 20 seconds East a distance of 376.84 feet to a 5/8 inch rebar with cap set;

thence South 02 degrees 05 minutes 59 seconds West a distance of 3.98 feet;

thence South 87 degrees 54 minutes 01 seconds East a distance of 15.59 feet to a 5/8 inch rebar with cap set;

thence South 09 degrees 43 minutes 55 seconds East a distance of 143.36 feet to a 5/8 inch rebar with cap set;

thence South 79 degrees 44 minutes 17 seconds West a distance of 50.78 feet to a 5/8 inch rebar with cap set;

thence South 09 degrees 56 minutes 59 seconds East a distance of 22.46 feet to a 5/8 inch rebar with cap set;

thence South 80 degrees 59 minutes 37 seconds West a distance of 33.95 feet to a point witnessed by a mag nail set 2.00 feet on the westerly prolongation and 2.00 feet southerly at right angles to the preceding course;

thence North 11 degrees 44 minutes 11 seconds West a distance of 22.41 feet to a 5/8 inch rebar with cap set;

thence South 79 degrees 56 minutes 26 seconds West a distance of 335.59 feet to a 5/8 inch rebar with cap set;

thence South 09 degrees 56 minutes 34 seconds East a distance of 77.39 feet to a mag nail set;

thence South 80 degrees 01 minutes 30 seconds West a distance of 109.29 feet to a 5/8 inch rebar with cap set;

thence North 09 degrees 58 minutes 39 seconds West a distance of 50.35 feet to a point;

thence South 79 degrees 09 minutes 09 seconds West a distance of 113.56 feet to a 5/8 inch rebar with cap set;

thence North 09 degrees 53 minutes 57 seconds West a distance of 40.61 feet to a point;

thence South 80 degrees 06 minutes 03 seconds West a distance of 40.51 feet to a 5/8 inch rebar with cap set;

thence North 09 degrees 53 minutes 57 seconds West a distance of 183.53 feet to a 5/8 inch rebar with cap set;

thence North 35 degrees 26 minutes 10 seconds East a distance of 13.83 feet to a 5/8 inch rebar with cap set;

thence North 79 degrees 58 minutes 05 seconds East a distance of 149.15 feet to a 5/8 inch rebar with cap set;

thence North 10 degrees 01 minutes 55 seconds West a distance of 419.90 feet to a 5/8 inch rebar with cap set on the southerly line of said Railroad;

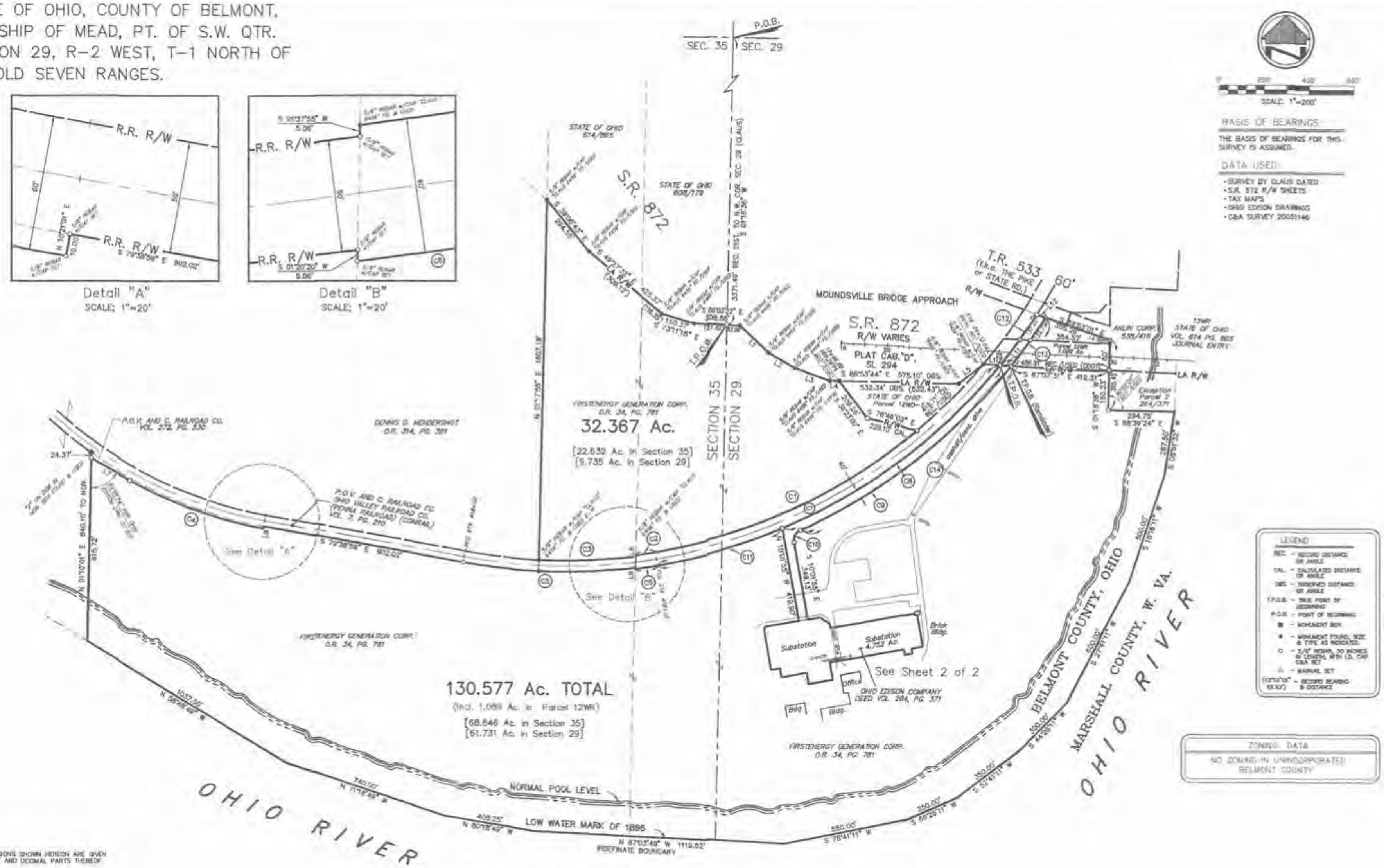
thence northeasterly along the southerly line of said Railroad 1227.77 feet along the arc of a curve deflecting to the left having a radius of 2485.53 feet, a delta angle of 28 degrees 18 minutes 08 seconds, a chord length of 1215.33 feet, and a chord bearing of North 52 degrees 58 minutes 35 seconds East to the **true point of beginning;**

The above described tract of land contains 4.752 acres of land as surveyed by Timothy J. Briggs, PS 7495, Campbell & Associates, Inc. of Cuyahoga Falls, Ohio in July of 2005 and updated by James P. Yurkschatt, PS 7809 of Campbell and Associates in August of 2016. Of the total acreage, 0.133 acres is encompassed by Parcel 12WR, for State Route 872. Basis of bearings is assumed. 5/8 inch rebar 30 inches long with yellow plastic cap marked "Campbell & Assoc. Inc." set unless noted.

Attachment 2

Map of the Property Boundary

STATE OF OHIO, COUNTY OF BELMONT, TOWNSHIP OF MEAD, PT. OF S.W. QTR. SECTION 29, R-2 WEST, T-1 NORTH OF THE OLD SEVEN RANGES.



NOTE: DIMENSIONS SHOWN HEREON ARE GIVEN IN FEET AND DECIMAL PARTS THEREOF.

NOTE: THIS SURVEY WAS PREPARED WITHOUT BENEFIT OF A TITLE REPORT AND NO SEARCH OF THE PUBLIC RECORDS WAS MADE FOR EASEMENTS, RIGHT-OF-WAYS & ETC.

I HEREBY DECLARE THAT I HAVE SURVEYED THE LAND SHOWN ON THIS PLAT, AND HAVE FOUND OR SET THE PINS AND MONUMENTS SHOWN ON THIS PLAT OR WILL BE.

JAMES P. YURKSCHATT P.S. 7809
CAMPBELL & ASSOCIATES, INC.

08/12/2016
DATE

STATE OF OHIO JAMES P. YURKSCHATT 7809 REGISTERED SURVEYOR

CURVE DATA

CURVE	RADIUS	ARC LENGTH	CHORD LENGTH	CHORD BEARING	DELTA ANGLE	TANGENT
C1	2425.53'	1308.90'	1291.15'	S 65°11'56" W	30°52'17"	669.73'
C2	2461.12'	85.29'	85.29'	S 81°37'38" W	01°59'08"	42.65'
C3	2468.12'	431.69'	431.14'	S 87°38'56" W	10°01'46"	216.40'
C4	1945.08'	634.13'	631.33'	S 70°18'38" E	18°40'46"	319.90'
C5	2518.12'	770.43'	767.42'	S 88°25'17" E	17°32'37"	388.25'
C6	2521.12'	98.62'	98.51'	N 81°43'53" E	02°31'37"	49.29'
C7	2485.53'	1813.72'	1773.75'	N 59°43'48" E	41°48'34"	949.36'
C8	2485.53'	1227.77'	1215.33'	S 52°56'35" W	28°18'08"	626.68'
C9	2525.53'	1205.79'	1194.37'	S 51°50'51" W	27°21'19"	614.61'
C10	50.00'	65.94'	61.28'	N 27°44'48" E	75°33'35"	38.75'
C11	2485.53'	585.95	584.59	N 73°52'52" E	13°30'25"	294.34'
C12	2485.53	282.68'	282.53	N 35°34'01" E	06°30'59"	141.49'
C13	2525.53'	266.95'	266.88'	N 35°08'29" E	06°03'25"	133.62'
C14	2525.53'	1472.77'	1451.99'	S 48°49'06" W	33°24'44"	757.99'

LINE TABLE

LINE	BEARING	DISTANCE
L1	S 46°17'51" E	176.94'
L2	S 59°57'01" E	135.39'
L3	S 70°18'04" E	164.15'
L4	S 88°53'44" E	42.77'
L5	S 51°51'20" W	139.88'
L6	S 01°37'55" W	5.06'
L7	S 80°58'13" E	169.65'
L8	N 10°21'01" E	10.00'
L9	S 01°20'20" W	5.06'
L10	S 87°07'31" E	74.00'
L11	S 87°07'31" E	49.21'
L12	S 89°53'01" E	40.91'

INDEFINATE BOUNDARY
"HIGH WATER MARK PRIOR TO CONSTRUCTION OF U.S. GOVERNMENT DAM"

Date:	8/10/2016
Drawn By:	JM
Checked By:	TB
Field Book:	MM,TB,M,JC
Scale:	1"=200'

REVISIONS | DATE

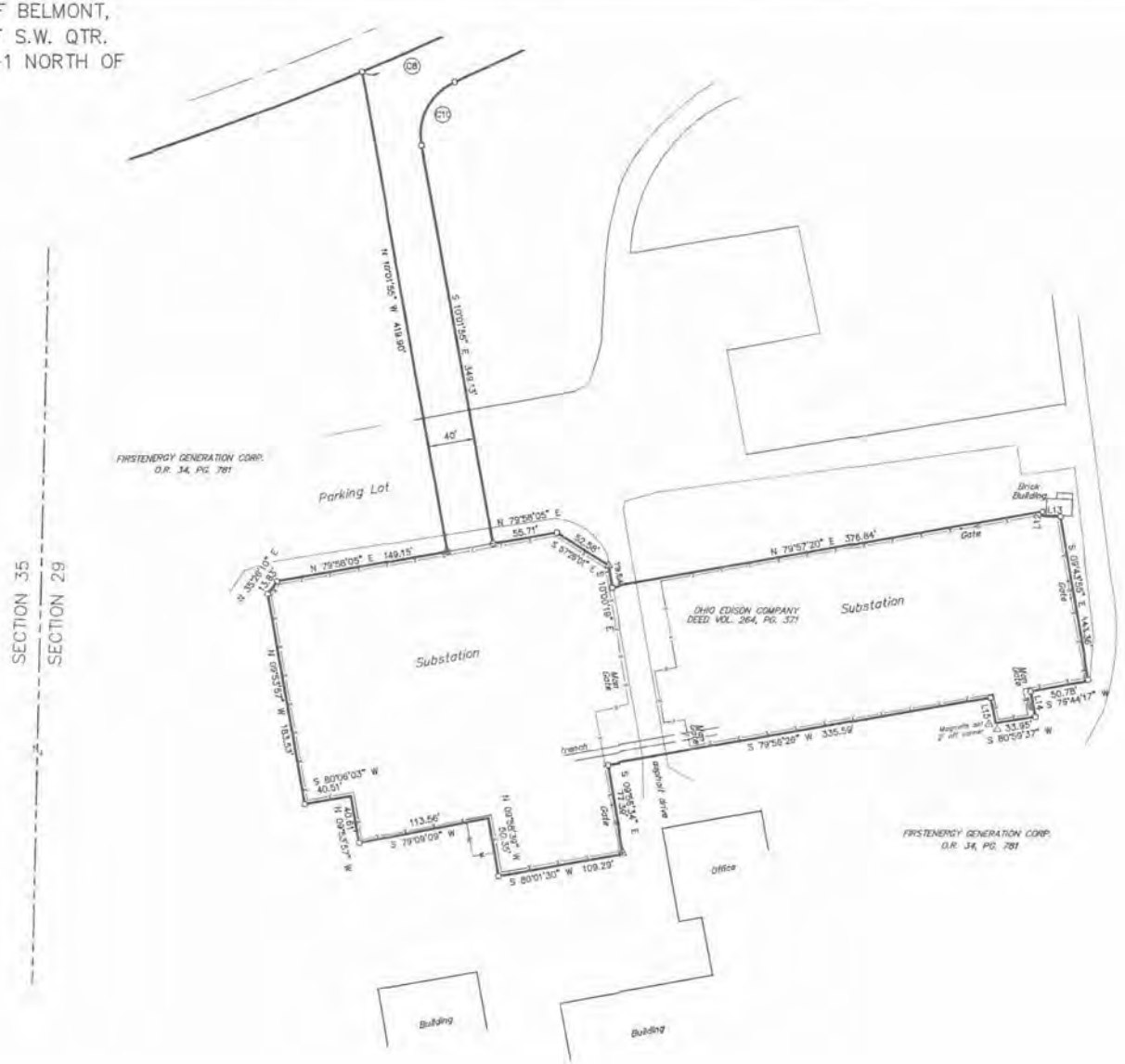
SURVEY PLAT

FIRSTENERGY BURGER GENERATING FACILITY
57246 FERRY CROSSING ROAD
SHADY SIDE, OHIO 43947-9700

CAMPBELL & ASSOCIATES, INC.
Surveying

JOB NO. 20160089

STATE OF OHIO, COUNTY OF BELMONT,
TOWNSHIP OF MEAD, PT. OF S.W. QTR.
SECTION 29, R-2 WEST, T-1 NORTH OF
THE OLD SEVEN RANGES.



0' 50' 100' 150'
SCALE: 1"=50'

BASIS OF BEARINGS

THE BASIS OF BEARINGS FOR THIS SURVEY IS ASSUMED.

LINE TABLE

LINE	BEARING	DISTANCE
L12	S 02°05'59" W	1.98'
L13	S 87°54'01" E	15.59'
L14	S 09°56'59" E	22.46'
L15	N 11°44'11" W	22.41'

LEGEND

REC.	- RECORD DISTANCE OR ANGLE
CAL.	- CALCULATED DISTANCE OR ANGLE
OBS.	- OBSERVED DISTANCE OR ANGLE
T.P.O.B.	- TRUE PLACE OF BEGINNING
P.O.B.	- PLACE OF BEGINNING
■	- MONUMENT BOX
●	- MONUMENT FOUND, SIZE & TYPE AS INDICATED.
○	- 5/8" REBAR, 30 INCHES IN LENGTH, WITH I.D. CAP CAMPBELL & ASSOC.
△	- MAGNAIL SET
(XXXX'N) XX.XX'	- RECORD BEARING & DISTANCE

SURVEY PLAT

FIRSTENERGY BURGER GENERATING FACILITY
57246 FERRY CROSSING ROAD
SHADY SIDE, OHIO 43947-9700

DATE	REVISIONS

Date: 6/10/2016
Drawn By: AM
Checked By: TB
Title Book: MAT TB KRJC
Scale: 1"=50'

CAMPBELL & ASSOCIATES, INC.
Surveying
2455 Hilltop Road, Suite 100
Mentor, Ohio 44060
(330) 940-4117
www.campbellsurvey.com

JOB NO.
20160189

SHEET 2 OF 2

II. Certified Professional (CP) Affidavit

State of Ohio)
) ss:
County of Franklin)

I, Daniel M. Bremer *[name of CP affiant]*, being first duly sworn according to law, state that, to the best of my knowledge, information and belief:

1. I am an adult over the age of eighteen years old and competent to testify herein.

2. I am a Certified Professional, No. 311 *[CP number]*, in good standing under Ohio Revised Code (ORC) Chapter 3746 and Ohio Administrative Code (OAC) Chapter 3745-300, also known as Ohio's Voluntary Action Program.

3. I have prepared a No Further Action (NFA) Letter for property referred to as The Former FirstEnergy R.E. Burger Power Plant and located at 57246 Ferry Land Rd Shadyside (Belmont County), Ohio (the "Property.")

4. I prepared the NFA Letter at the request of Anthony M Skicki, Manager, Environmental Remediation & Governance, FirstEnergy Corp. P.O. Box 16001 Reading, Pennsylvania 19612. The Property is owned by FirstEnergy Generation LLC. and Ohio Edison Company, 76 South Main, Akron, Ohio 44308.

5. I prepared the responses and Addendum to Ohio EPA's Review of the Voluntary Action Program (VAP) No Further Action (NFA) Letter for FirstEnergy R.E. Burger Power Plant, 16NFA666; Initial Notice of Deficiency and Reviewer Comments, received on November 8, 2016.

6. I have read the standards of conduct contained in OAC 3745-300-05, and met the standards while rendering professional services regarding the voluntary action at the Property.

7. The Property is eligible for the Voluntary Action Program pursuant to ORC 3746.02 and OAC 3745-300-02.

8. The voluntary action has been conducted and the NFA Letter has been issued in accordance with ORC Chapter 3746 and OAC Chapter 3745-300. As a result, I determined that the Property complies with the applicable standards contained in ORC Chapter 3746 and OAC Chapter 3745-300.
9. The voluntary action was conducted in compliance with all applicable local, state, and federal laws and regulations.

10. The NFA Letter and any other information, data, documents and reports submitted with the NFA Letter are true, accurate and complete.

Further affiant sayeth naught.

Signature of Affiant

Certified Professional's Current Seal here:

DANIEL M. BREMER
CERTIFIED PROFESSIONAL (CP311)
ORC Section 3746.04 (B)(5)
OAC Rule 3745-300-05
My certification expires April 3, 2017

Sworn to before me and subscribed in my presence this 23 day of NOV., 2016.

Notary Public

GORY W. BROWN
Notary Public, State of Ohio
My Commission Expires
October 31, 2017

Appendix 2

Setting the Standard for Automation™

New Optical Gas Imaging Technology for Quantifying Fugitive Emission Rates

Standards
Certification
Education & Training
Publishing
Conferences & Exhibits

Authors

Yousheng Zeng, PhD, PE, Jon Morris, and Albert Sanders
Providence Photonics
Baton Rouge, Louisiana

Duane McGregor and Petroula Kangas
ExxonMobil Research and Engineering Company

Hazem Abdel-Moati
ExxonMobil Upstream Research Company - Qatar

Objective and Agenda

- This presentation introduces advances in Optical Gas Imaging (OGI) Technology that allows improved Leak Detection And Repair (LDAR) surveys by more efficiently identifying fugitive sources and quantifying emission rates

- Agenda
  - Overview of current LDAR methodologies
  - Uncertainties in EPA Method 21
  - Introduction to Quantitative Optical Gas Imaging (QOGI)
  - Performance and application of QOGI technology
  - Conclusions

Current LDAR Methodologies

Leak detection and quantification methods:

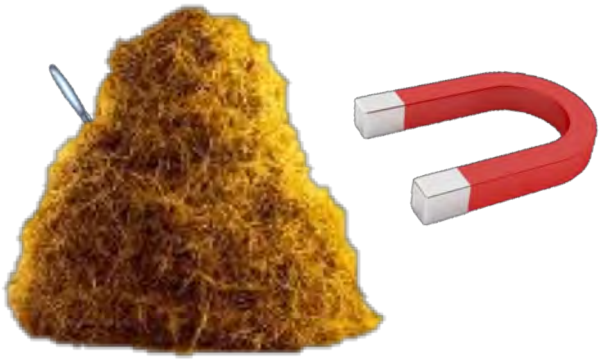
- EPA Method 21 based method
  - Used by most LDAR Programs
- Bagging test
- Optical Gas Imaging (OGI) method
  - A great visual tool, but it's currently qualitative
  - Approved as an Alternative Work Practice (AWP), but still requires Method 21 application
  - Widely used as a fast response visual tool, but very limited use for LDAR compliance

Method 21 vs. OGI for LDAR

Method 21

- Finding a leak is like looking for a needle in a haystack – and you need to inspect every “straw”!
- Inspecting hundreds of components to find one leak (or no leaks)

OGI Technology



- OGI allows for rapid screening of components – focusing on the “needle” rather than every “straw”
- Much more efficient method for finding significant leaks
- Potential to reduce the cost of LDAR compliance

Method 21 vs. OGI for LDAR (Cont'd)

Method 21

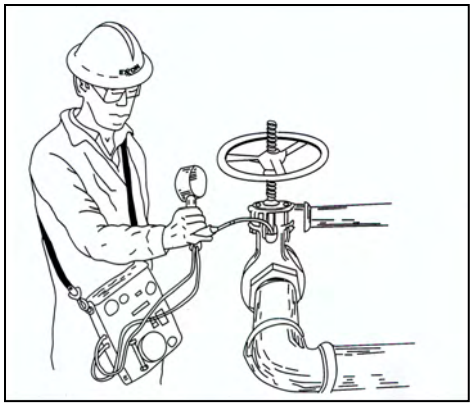
- Developed to reduce fugitive VOC emissions at time when there was no better method; contributed VOC reduction throughout decades
- Not intended for accurately quantifying emission of each leak
- Significant uncertainties
- Labor intensive

Current OGI Technology

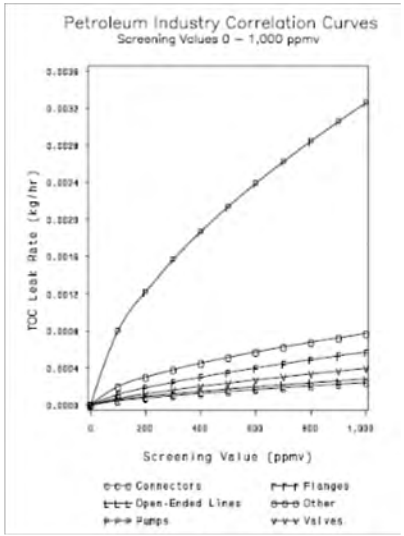
- Higher productivity – can find significant leaks faster than M21
- Provides qualitative result only (i.e., image), no estimate of emissions

Understanding Uncertainty in Current Method 21 Based LDAR Programs

Typical LDAR Process:



Screen components to get Screening Values (SV) in ppmv



Apply correlations to estimate emission rates (ER)

ER (lb/hr)

Report ER.

Understanding Uncertainty in Method 21 Screening Values

Small leak area (single point)

Large leak area (diffused leak)

Same leak rate
(500 cc/min propane)

- Only concentration is directly measured by Method 21
  - The size of the leak is not considered
  - Different leak rates could have same concentration, and vice versa
- Response Factors (RFs) applied to account for differences between calibration and measured gases
  - Instrument dependent
  - Compound dependent

Response Factor Overview

- Flame Ionization Detector (FID) used in Method 21 is calibrated using one calibration gas (e.g., methane)
- FID reading can differ significantly for other gases
- RF is a pre-determined ratio between the FID reading of calibration gas and the gas in question.
  Actual Conc. (ppm) = [SV (ppm) from FID] / RF
- EPA 1995 leak detection protocol, App. D includes RF of ~200 compounds.
- RF varies from compound to compound, can be a order of magnitude different, and can be different from instrument to instrument.
  - Example: Propane RF ranges from 0.63 to 0.88
    Ethylene RF: 0.52-4.49
    Methanol: 1.88-21.73

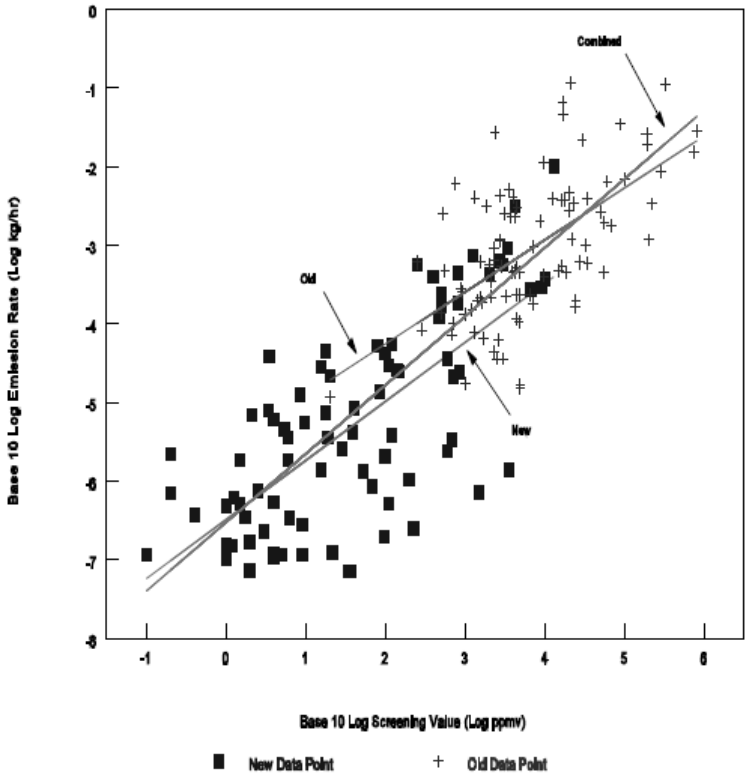
EPA Protocol Regarding RF

- EPA 1995 Protocol (Sect. 2.4.2)
  - If RF<3, no adjustment. A potential bias up to 300% (200% error).
  - If RF>3, apply RF adjustment.
  - Instrument is supposed to have RF<10 (EPA 1995 Protocol, Sect. 3.2.2.1, Table 3-1).
- If RF is not properly applied, resulting SV can have even higher error

Understanding Correlation Equations

- Empirical equations based on field data (SV vs. ER from bagging tests)
- Cannot be used above certain value (pegged value, e.g., 10,000 or 100,000 ppm)
- R^2 for these correlations range from **0.32 to 0.54** (EPA 1995 protocol, App. C, Table C-2)

Example:
Gas Valve Regression Equations

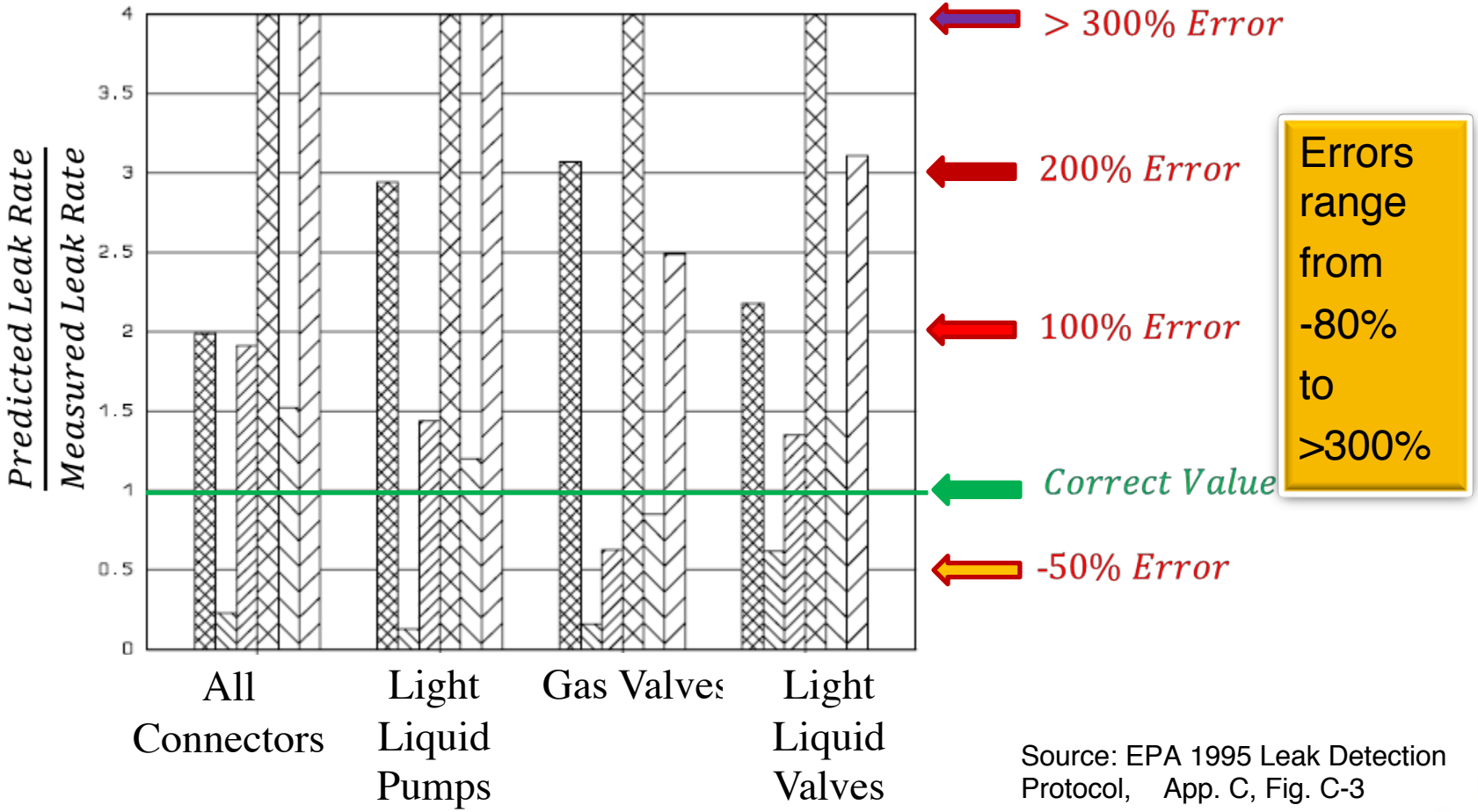


Source: EPA 1995 Leak Detection Protocol App. B, Fig. B-3

Understanding Uncertainty in Correlation Eq.

Example from 1995 EPA leak detection protocol

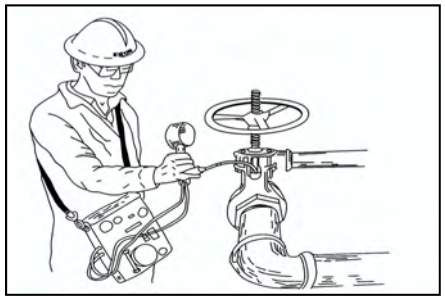
Three correlation equations were derived from 1980, 1993, and combined field data, and applied to 1980 and 1993 data, thus 6 sets of results (6 bars in the chart) for each of the 4 component types.



Source: EPA 1995 Leak Detection Protocol, App. C, Fig. C-3

In Summary: Method 21 Has Uncertainties That Can Significantly Affect Leak Rate Estimates

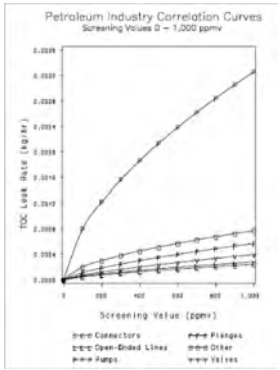
Screening Value



Uncertainty:
up to 200%

Errors up to 200% could be introduced by not correcting for RF. There are other sources of errors as discussed earlier.

Correlation Eq.



Uncertainty:
-80% to +300%
or worse

Based on EPA 1995 Protocol, App. C.

ER
(lb/hr)

Combined Error?

Overcome M21 Uncertainties by Directly Measuring Leak Rate Using Quantitative OGI (QOGI)

Infrared (IR) gas detection camera (currently available)

USB or wireless connection

USB

Tripod to steady the image

QL100 – an accessory device that can quantify and report the mass leak rate (i.e., lb/hr)

QOGI: Working Principle

- IR images of a leak are analyzed for intensity on a pixel-by-pixel basis
- Each pixel represents a column of hydrocarbon vapor between the camera and the background
  - Pixel contrast intensity is a function of temperature difference between the background and the plume (ΔT)
  - At a given ΔT, the intensity is proportional to the hydrocarbon molecules in the vapor column
- Leak rate drives both pixel intensity and number of pixels. Inversely, the combination of the two factors determines leak rate.

QOGI: How Does It Work in the Field?

- Use IR camera to survey for leaks.
- When a leak is detected, connect the QL100 device to the camera (USB or wireless).
- User enters ambient air temperature and estimated distance from the plume to the camera.
- QL100 does the rest
  - Collects images for about 30 seconds, uses proprietary algorithms to automatically calculate the mass leak rate in lb/hr
  - Provides immediate result in the field

QOGI: What Conditions Have Been Tested?

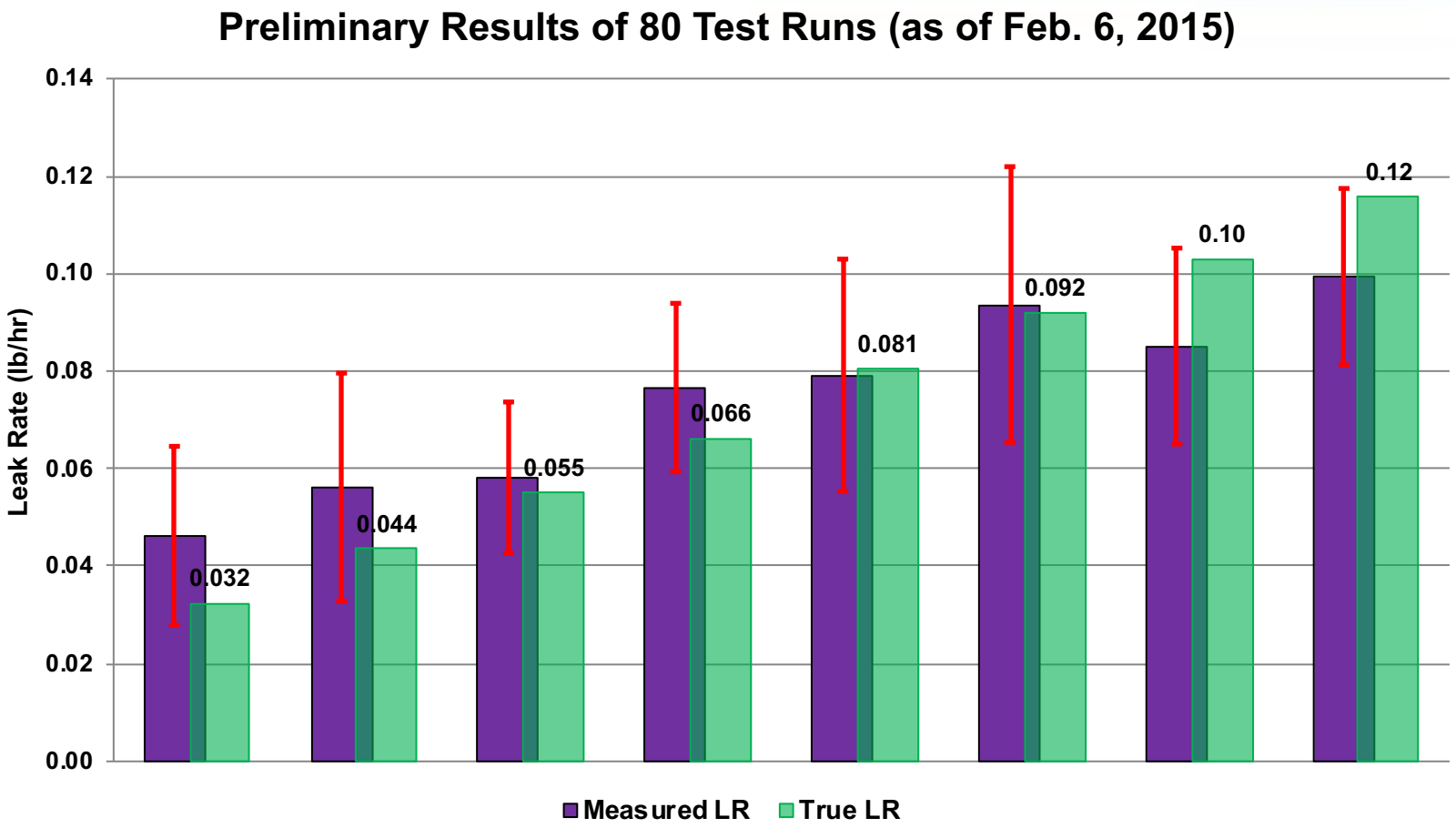
Preliminary tests have been performed (80 tests to date). More tests are underway.

The results reported here were based on propane, and included the following environmental conditions:

- Types of background: uniform temperature controlled metal board, building wall, gravel.
- Sunny and cloudy days; in sunlight and in shade.
- Ambient temp.: 37-95 ^{O}F (3-35 ^{O}C)
- Relative humidity: 50%-90%
- Wind conditions: moderate
- Distance: 10 ft.

Tests to date have indicated that QOGI is robust under a variety of environmental conditions

QOGI: How Accurate Is It?



- QOGI Accuracy: -17% to 43% across all leak rates and all 80 tests
- QOGI accuracy very promising vs Method 21

QOGI: Does It Work for Different Compounds?

Majority of tests were done using propane leaks. A limited number of tests have been done for methane and ethylene. IR Response Factors (RF) have been developed to measure different compounds accurately while maintaining the simplicity of the method. The measurement is calculated as if the gas were Propane and then scaled by IR RF. Preliminary results show this approach is viable.

Compound	Range of Leak Rates (lb/hr)	Number of Tests	Average Error %	Standard Deviation of Error %
Methane	0.12 to 0.24	25	24%	39%
Ethylene	0.03 to 0.11	20	19%	34%

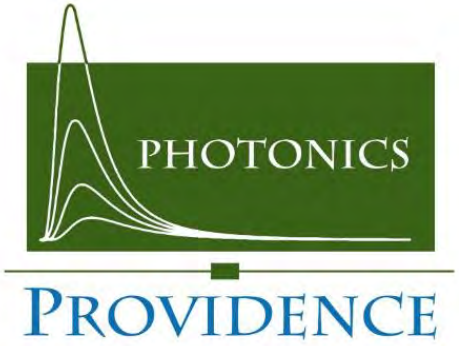
QOGI: How Does the IR RF Work?

- User can select a compound, or a mixture of compounds.
- QL100 will automatically apply the proper IR RF to adjust the quantitative result
- IR RF is developed using spectral response of each compound
- Similar to Method 21 RF with two important differences
  - IR spectral response and IR RFs are less dependent on the instrument compared to instrument used in Method 21
  - IR RF would be incorporated directly into software with minimal input from the user (vs. Method 21, where RFs are not always applied rigorously)
- These factors contribute to a more accurate leak rate provided by QOGI vs. Method 21 SV.

Conclusions

- It has been demonstrated, with initial but compelling data, that ***quantitative*** optical gas imaging (QOGI) is technically feasible.
- Method 21 ***estimates*** emission rates; QOGI ***directly measures*** emission rates.
- QOGI is efficient and provides mass emission rates, making it attractive as a primary LDAR technology.
- More field testing is underway to further qualify the technology and understand advantages compared to Method 21.
- QOGI is not limited to LDAR applications. It can be used for applications such as product loss, methane emissions, remote assessment of toxic gas release, etc.

Questions?



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